

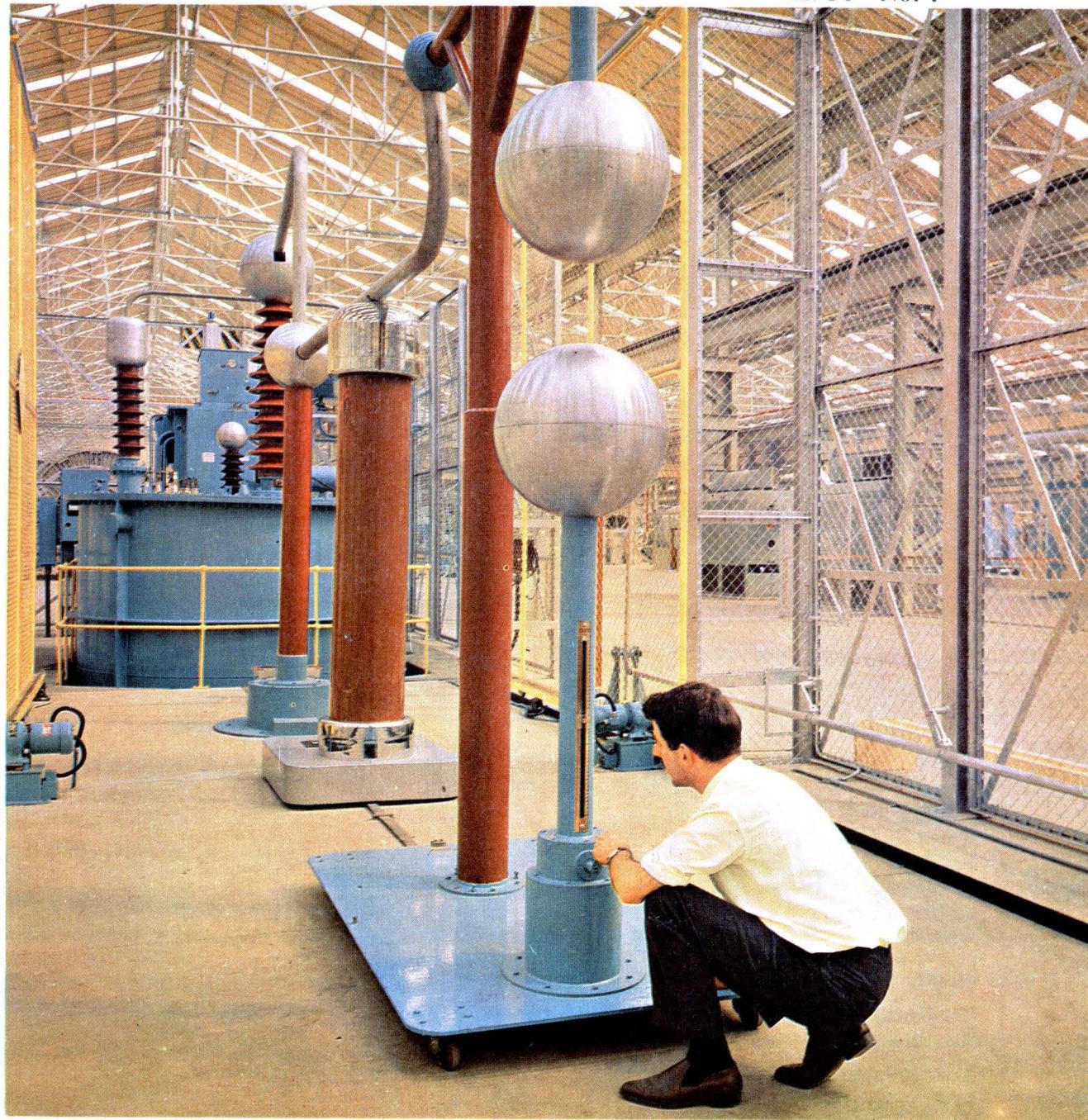
# ELECTRONICS

## Australia

*October, 1968*

Incorporating RADIO, TELEVISION & HOBBIES

Vol. 30 No. 7



**30c**

HIGH-VOLTAGE TEST EQUIPMENT

Servicing with "bottled cold"  
Measuring traffic noise

• Space mystery  
L.S.I. explained



# Perfect Stereo



Stereo has now reached the state of the art where, over an extensive range of programme materials, there is utmost clarity of reproduction, closely approaching the original. However, to achieve this, all imperfections in a stereo system must be avoided by careful selection of components, (i.e. ALL components — if just one is not suitable it will downgrade the whole system). Suitable components, specially imported by G.R.D. Instruments are now available at reasonable prices for those enthusiasts who find satisfaction from achieving such perfect stereo. Examples are listed below. If you are interested, you are invited to enquire through your Hi-Fi dealer or write to G.R.D. directly for free literature.

#### From DYNACO of USA

Amplifiers of extremely high standard of technical perfection. All ratings are continuous RMS power per channel. Available in Kitform or factory assembled. Power Amplifiers: — "Stereo 120" (60 watts—solid state), "Stereo 70" (35 watts—tube), "Stereo 35" (17½ watts—tube), "SCA 35"—with pre-amp Stereo 17½ watts—tube), "MK IV" Mono (35 watts—tube).

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#### From A & D of UK

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#### From ACOUSTICAL of Holland

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The All Balance arm. All ball bearings, with the new type anti-skate, oil damped "lift", takes light weight cartridges.

#### From SRT of Copenhagen

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#### From B & O of Denmark

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Tape Deck Beocord 1500 De Luxe or complete Tape Recorder and Mixer and Output amplifier: Beocord 2000 De Luxe. SN ratio better than 55dB, record/playback 30-20,000 Hz.

Main amplifier Beomaster 1000 2 x 17 watts RMS or Beolab 5000 2 x 60 watts RMS.

Speaker systems Beovox 500, 2200, 2400, 5000 etc. To handle power from 5 to 30 watts DIN.

Listed below are examples of Retailers of Hi-Fi equipment who are able to supply "GRD" components:—

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**Canberra:** J. B. Young.

**Perth:** Carlyle & Co., Les Leonard & Co., Atkins (W.A.) Ltd., Alberts T.V. & Hi-Fi.

**Sydney:** Wedderspoon & Co., United Radio Dist., Arrow Electronics, Asdig Stereo, Broadway Electronics (Sales), A. Victor & Co.

**Newcastle:** Dynamic Sound, Martin de Launay, Lawrence & Hansen.

**Brisbane:** Brisbane Agencies, A. E. Harold, C. A. Pearce & Co., Trackson Bros., Chandlers.

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**Launceston:** W. & G. Genders P/L.

**Hobart:** Homecrafts.

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# ELECTRONICS

## Australia

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## Control tones . . .

Have you ever been sitting quietly in a public gathering, when the speaker's voice has been punctuated by a series of whistles emitted by the public address system — whistles or tones that last for several seconds each and spread over best part of a half-minute?

I have . . . often.

Have you ever been playing an electronic organ, perhaps privately, perhaps in public, when it has emitted a series of notes of its own volition, pitched vaguely and unharmoniously a couple of octaves above middle C?

I have . . . often.

Have you ever heard similar sounds coming from a radio receiver, a television receiver, a hi-fi installation?

Once again, I have . . . often.

In fact, once having reacted to the tones, one can become extraordinarily sensitive to them and, in the quietness of the home, I have even heard them coming from an electric heater and an electric clock! The latter instances, of course, are purely matters of curiosity but those mentioned earlier are not. In such cases the tones can be anything from merely annoying to downright embarrassing.

Electricity supply authorities superimpose them on power lines to switch off-peak water heaters. Others use them, I understand, to control sub-stations and other units in the reticulation system. From the viewpoint of the authorities, the system is doubtless very neat and very convenient but what about the customers? I wonder how much attention was paid to the likelihood of the tones penetrating all kinds of audio equipment, as they are now doing?

Not enough, apparently.

It may be argued that a few volts of audio tone should be blocked by the power supply filter; that it shouldn't penetrate circuits via the heater wiring; that it shouldn't get into input circuits via the earth return.

Maybe it shouldn't, but the fact remains that, by these or other means, it does penetrate audio systems — and perhaps others that I haven't heard about. What's more, there is reason to believe that tones are being superimposed on lines more and more frequently and at greater amplitude.

Unless a halt is called somewhere, more than hot water systems are likely to be switched on!

*W. N. Williams*

**October, 1968**

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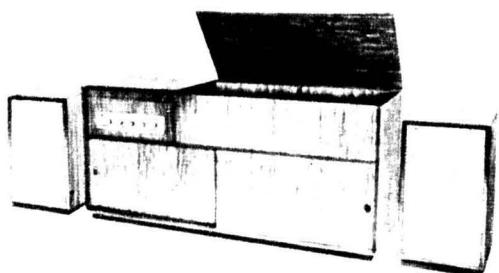
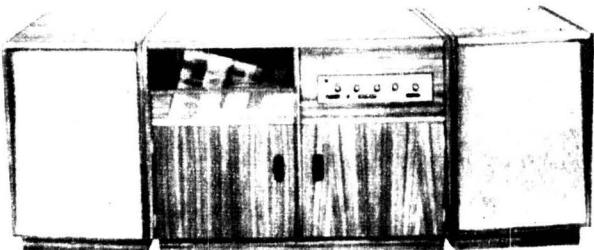
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**COVER PICTURE:** Ferranti 350KV, 750KVA AC testing equipment installed at the Renfrew works of Scottish Cables Ltd. The equipment, used for testing cables up to 275KV, is of the series-resonant type, featuring low KVA demand and freedom from spurious resonance effects.

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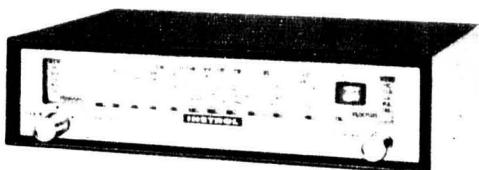
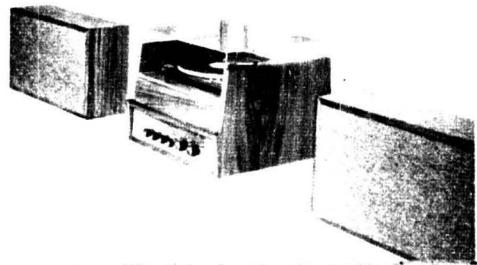
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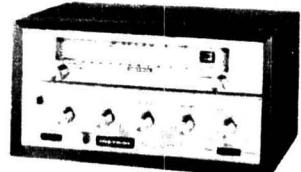
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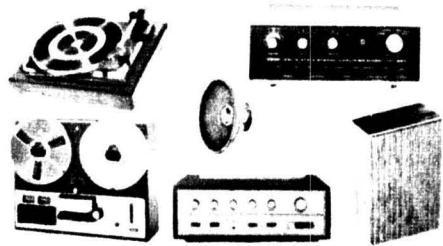
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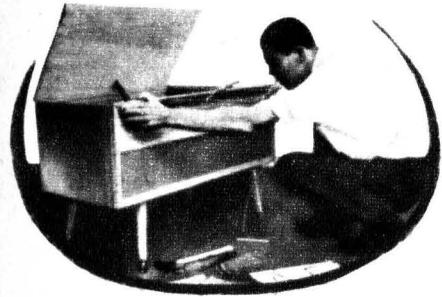
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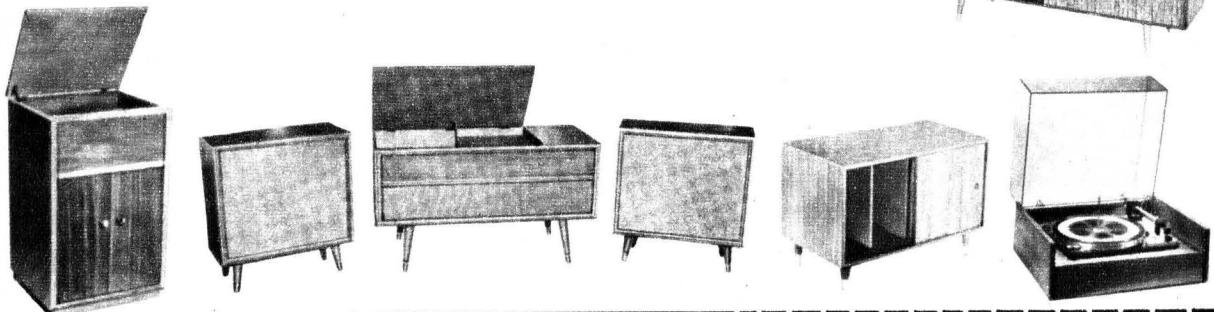
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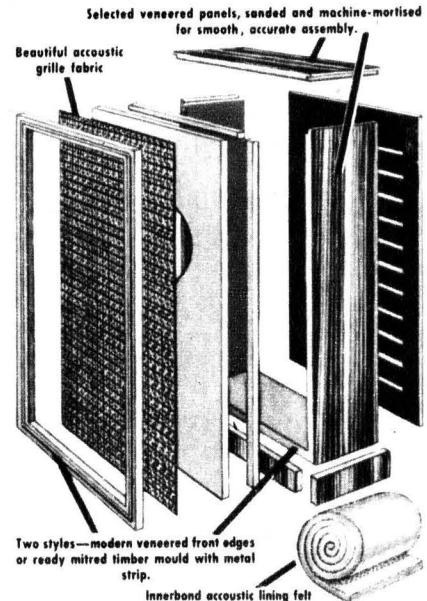
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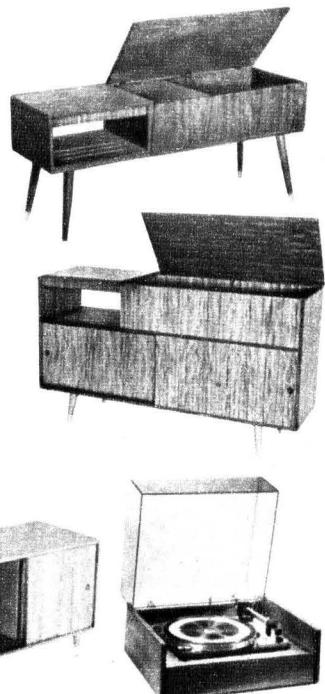
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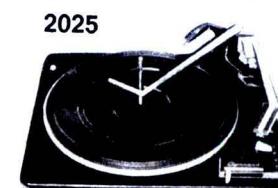
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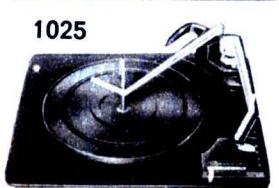
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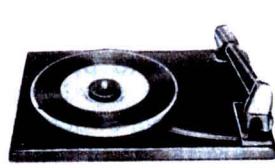
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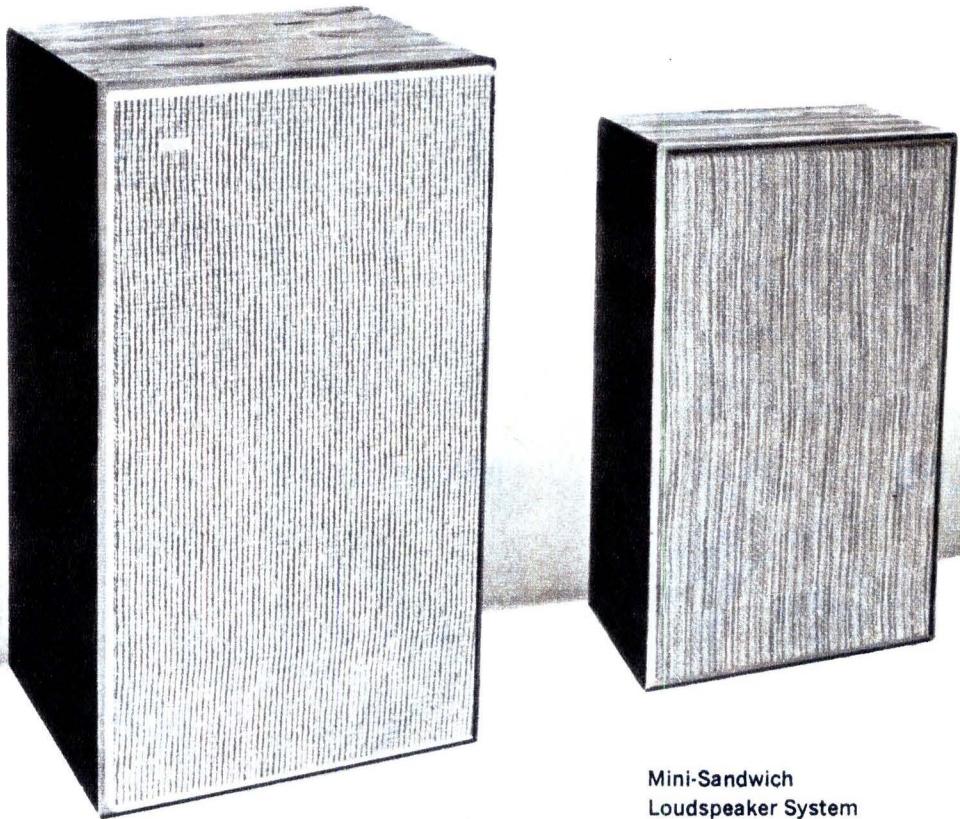
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## A Short History of the "Talkies" . . .

by Jamieson Rowe

The second of two parts of a brief survey of the development of the modern sound motion picture. It describes the events leading up to the commercial advent of talkies, and then looks at later developments.

Although Dr Lee De Forest apparently did not begin working explicitly on the development of sound pictures until around 1918, he had already made an implicit and quite significant contribution to their development as early as 1906 through his work on the development of the triode thermionic valve. There is some controversy as to whether De Forest or Sir Ambrose Fleming actually invented the triode, but in any event De Forest filed a patent for his "Audion" in 1907, and spent many of the subsequent years in developing amplifiers and other equipment based upon it.

Due to a number of largely unrelated factors, not the least of which was World War I, the discovery of

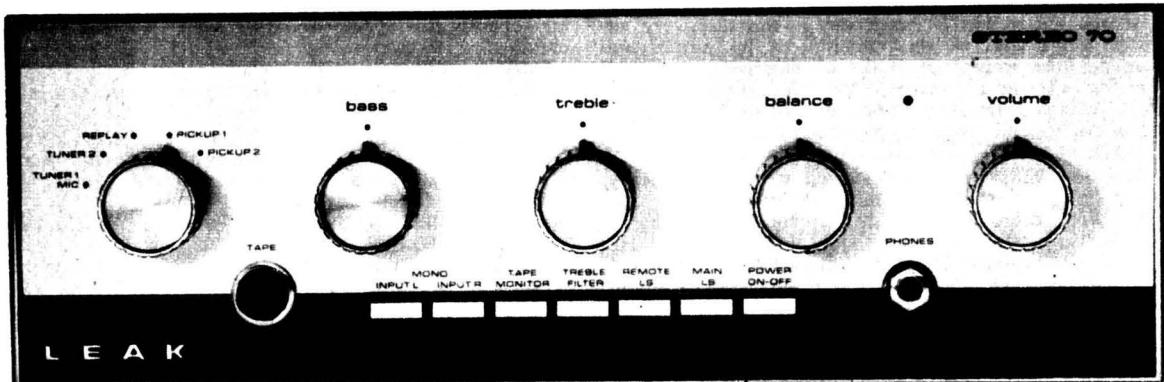
place of selenium, and in the following two years had developed for the Navy an infra-red signalling system using the cell.

De Forest's purchase of sample Thalofide cells from the Case laboratory was the first of a series of contacts between himself, Case and Sponable; and in the ensuing years the interchange of information between the three was to prove particularly profitable. Case and Sponable were the basic researchers, while De Forest was to a large extent the incorporator-entrepreneur.

De Forest found that the Case Thalofide cell proved admirable for photographic reproduction, giving results far superior to the selenium cells which he had been using

... Part Two

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Due to a number of largely unrelated factors, not the least of which was World War I, the discovery of the triode valve and of its potential as an amplifying device made little impact upon the development of sound pictures for almost 12 years. Yet this discovery was ultimately to play a major part not only in the commercial realisation of sound motion pictures, but also in the development of radio, television, radar and electronics.

When, in 1918, De Forest started working explicitly on the problems of photographic sound recording, his first experiments were with a high frequency gas discharge lamp as the source of modulated light for recording. He carried out experiments in both America and Germany, but with little success. Then in 1920 he decided to obtain samples of a new type of photoelectric cell which had been discovered about three years earlier by Theodore W. Case.

Case was an electrical engineer who had become interested in photographic sound recording while a student at Yale University in 1911. In 1916 he had been joined by Earl I. Sponable, a graduate from Cornell, and the two had set up the Case Research Laboratory in a small building in Auburn, New York. In 1917 the laboratory had developed the "Thalofide" cell, an improved photoelectric cell employing the compound thallium oxy-sulphide in

place of selenium, and in the following two years had developed for the Navy an infra-red signalling system using the cell.

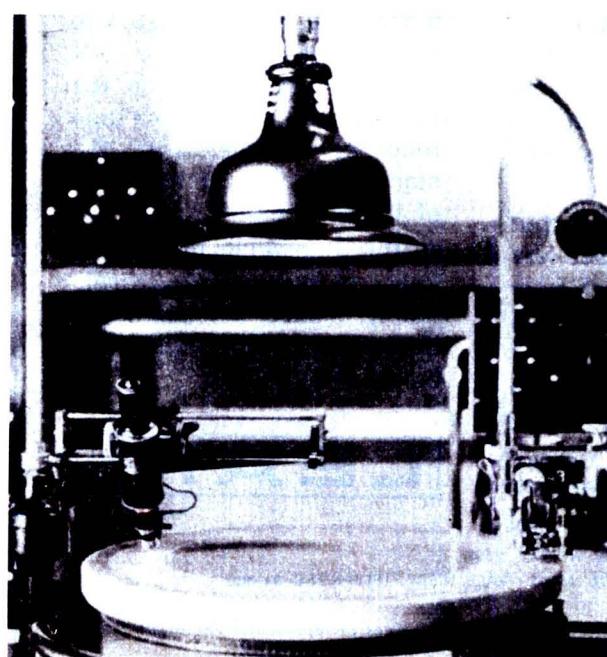
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De Forest found that the Case Thalofide cell proved admirable for photographic reproduction, giving results far superior to the selenium cells which he had been using previously. However, he was still unable to make satisfactory recordings, either with high-frequency gas discharge lamps or thin-filament tungsten incandescent lamps. He wrote in later years that, at about this time:—

"I well remember the grim satisfaction I felt when, for the first time in reproducing a photographic record of my voice, I was able clearly to determine whether or not it was being run backwards!"

In mid-1922 Case and Sponable developed the "Aeolight" recording lamp, which consisted at first of an argon-filled thermionic diode operated in the discharge region. The Aeolight represented a significant improvement over the high-frequency discharge lamps with which De Forest and others had been experimenting, as it operated at a relatively low voltage (200-400V), was easily modulated electrically and produced light which was somewhat more appropriate for the photographic emulsions available at the time.

De Forest obtained sample Aeolights late in 1922, and with the assistance and advice of Case and Sponable he obtained by March, 1923, results which were sufficiently good to prompt him to embark immediately upon the production of sample commercial sound pictures.



## ... Part Two

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*At left is shown the recording of a "Vitaphone" wax master disc, while above is a Warner Brothers' advertisement in the "New York Times" of August 7, 1926 — the morning after Vitaphone's debut.*



*A Fox Movietone company in the Mojave Desert, in mid-1928. They were probably shooting "In Old Arizona", the first talkie to be recorded out-of-doors on location.*

Apparently Case and Sponable were somewhat less enthusiastic about the results than De Forest, being of the opinion that considerable development work remained to be done before the results would be likely to justify commercial production and promotion. However, De Forest was undaunted, and in March and April, 1923, he gave demonstrations of his sound pictures both to the Press and to the New York Electrical Society.

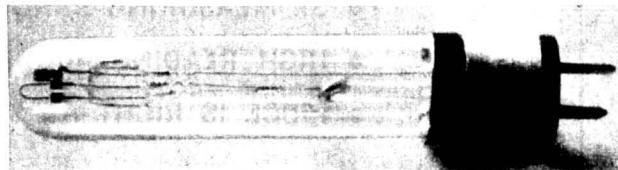
In doing so he not only ignored the advice of Case and Sponable, but in announcing and demonstrating the wonders of his new "Phonofilm" system he also omitted entirely to give credit to Case for the development of both the Aeolight lamp and the Thalofide cell. The former device was referred to as the "Photion," for which he himself claimed credit.

De Forest gave his first public exhibition of short Phonofilms at the Rivoli Theatre in New York on April 15, 1923, and in the remainder of that year he produced and exhibited some 25 short sound subjects. In the next year he recorded speeches by President Coolidge, Senator La Follette and other notables, in most cases with considerable assistance by Case and Sponable. The latter were continuously making improvements to the system, both by developing improved Aeolights and photocells and by refining the camera and projector mechanisms in which these were incorporated. They also showed De Forest ways of obtaining better performance from his Audion amplifiers.

In September, 1925, the working arrangement between De Forest and the Case Laboratory was terminated, due to "business complications." However, Case and Sponable decided that they would continue working on sound motion pictures, as they were convinced that considerably improved reproduction would be possible if they could but find better solutions to some of the technical problems.

Almost immediately they started development of an improved sound reproducing attachment for standard projectors, and of an improved sound camera. Development of the latter was undertaken with the co-operation of the Bell and Howell Company.

In designing these improved mechanisms Case and Sponable found it necessary to depart considerably from the standards which had been used by De Forest. Whereas the latter had used sound recording and reproducing attachments which mounted above the picture taking and projecting mechanisms so that the sound record lagged the picture record on the film, Case and Sponable found it desirable to adopt the opposite approach whereby the sound lead the picture. The standard they adopted was a



*The "Aeolight" gaseous discharge recording lamp, shown separate and mounted in its camera fitting. Developed in 1922 by Theodore Case and Earl Sponable, it was at the heart of the first commercial sound-on-film system.*

film displacement of 20 frames (14½in), which was later to become the industry standard.

The results were very promising, the sound quality obtained being far superior to that achieved by De Forest. However there were business problems, because in order to employ thermionic valve amplifiers they had to obtain a licence from the Western Electric Company, which was the current owner of the relevant patents. As the latter company was carrying out work of its own into sound pictures, it was not particularly keen to co-operate.

During 1925 and early 1926 Case and Sponable had conferences with most of the major companies in both the electronics and motion picture industries. However, virtually nothing arose from these meetings, mainly it would appear because of the extremely confused situation concerning the thermionic valve patents. Apart from this, the motion picture producers were almost entirely disinterested in the prospect of sound pictures.

Only two producers had any avowed interest in the prospect of sound pictures: William Fox and the Warner Brothers, both of which had entered the industry as exhibi-

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itors and subsequently expanded into the production field. As events transpired, it was to be these two firms which would force the whole American motion picture industry to change completely over to sound films within the short space of two years.

In early 1926 Fox heard a report of the success of the Case-Sponable sound system, and with characteristic enterprise and commercial acuity he immediately asked the inventors to visit him for a private demonstration and conference. The result was that mid-1926 saw the formation of the Fox-Case Corporation, the building of the first two commercial sound picture studios (designed by Sponable and built at 460 West 54th Street), and the coining of "Movietone" as the commercial name for the Case-Sponable system. The photographic system of producing sound motion pictures seemed to be finally becoming a commercial reality.

Yet while this was in fact the case, and while the photographic sound-on-film system was to become the standard sound film system for many years to come, it was not Movietone which finally catalysed the sound revolution. Ironically this function was to be performed by a rival and short lived sound-on-disc system promoted by the commercially ailing Warner Brothers. Like Edison and his phonograph years before, the industry was to be temporarily side-tracked by the gramophone.

The close of 1925 had apparently found the Warner Brothers organisation on the verge of ruin, largely because as one of the most recent entrants into the motion picture production field, their pictures were virtually "locked out" from the big American exhibiting chains tied to established production companies. Desperate action was needed if they were to prosper.

During 1925 two research teams at the Western Electric Company's Bell Telephone Laboratories had been working on sound systems for motion pictures. One team, headed by Dr J. P. Maxfield, had been working on a sound-on-disc system; the other, headed by Drs Crandell and MacKenzie, had been working on a sound-on-film system based on an improved lightvalve modulator unit developed three years earlier by Dr E. C. Wente.

At the end of 1925 the Maxfield team had reached a stage where they could make recordings of a quality far superior to that which had been thus far produced by the sound-on-film research team. In fact the recording quality of their sound-on-disc system was quite outstanding for that time; so much so that news of their success was not long in reaching the ears of the Warner Brothers.

Warners acted swiftly on hearing this news, sensing that the addition of sound to their pictures might conceivably provide the essential lever necessary if they were ever to force their way into the field of large-scale distribution. Enlisting the aid of W. J. Rich, a financier, they negotiated with the Western Electric Company and subsequently in April, 1926, signed a contract giving them an exclusive licence for recording and reproducing sound-on-disc pictures using the Maxfield system. The system was christened "Vitaphone," and a joint subsidiary Vitaphone Company was formed to handle its commercial exploitation.

On August 6, 1926, the first public performance of Vitaphone was given at the Warner Theatre, New York. The program commenced with a lip-synchronised filmed speech in which Vitaphone was introduced to the audience by Will Hays, head of the Motion Picture Producers and Distributors of America censorship office. Following this there were musical shorts featuring Mischa Elman, Martinelli and Marion Talley, and finally John Barrymore's silent film "Don Juan" with a recorded musical accompaniment by the New York Philharmonic Orchestra.

The response of public and Press was quite favourable, but not sufficiently so to convince the industry that sound pictures had arrived.

During the latter part of 1926 and the early months of 1927 both the Fox-Case Corporation and the Vitaphone Company worked on their sound pictures. In January, 1927, the first public showing of Movietone films was given at the Sam Harris Theatre, using a Case sound attachment and Western Electric amplifiers (Fox-Case had obtained a sub-licence from Vitaphone to use Western Electric amplifiers in December, 1926). Again the response was quite favourable, but by no means exhilarating.

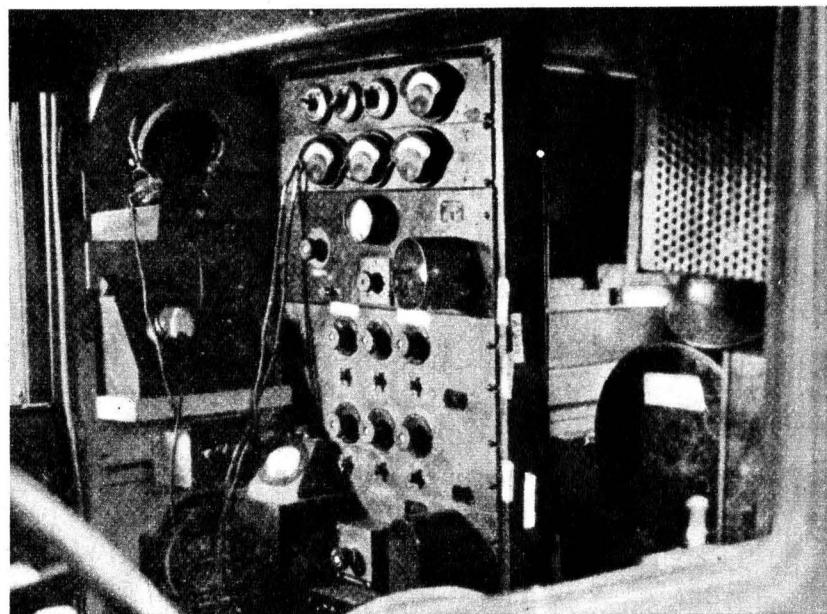
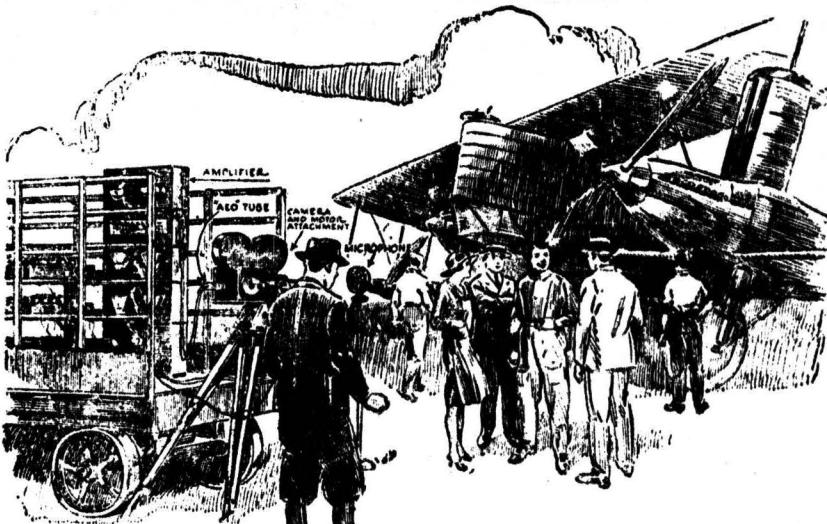
In May, 1927, Fox-Case produced a West Point revue as a Movietone feature, and presented it at the newly opened Roxy Theatre in New York. At the same time a field recording outfit was in Italy recording a speech by Mussolini and a number of shorts dealing with the Italian Army. In June another Movietone field team recorded the Washington welcome for Charles Lindbergh.

During this time Warners and the Vitaphone Company had been working on their first sound feature, which they presented on October 6, 1927. The film was Al Jolson's "The Jazz Singer," a somewhat pedestrian film which consisted mainly of a string of Jolson ballads. Yet when in the second reel Jolson finished his first song, turned and said to the audience, "Wait a minute, wait a minute! You ain't heard nothin' yet . . ." audiences were electrified. The reaction was tremendous, and left no doubt that sound pictures had finally arrived.

Spurred by the great success of "The Jazz Singer," both Warners and Fox-Case began working on sound pictures in earnest. Later in the same month Fox showed their first "Movietone News" sound newsreel, at the New York Roxy Theatre, while plans were being produced for building new sound studios on their Hollywood lot. Meantime the other big American producers saw both the inevitability of sound pictures and the lead taken by Warners and Fox, and also began working on both sound studios and productions.

Some idea of the consequent rapid growth of sound pictures may be afforded by the number of theatre sound installations recorded over a period of 12 months. At the end of 1927, Sponable notes that in America there were only 157 theatres equipped for sound, with only 55 able to reproduce sound-on-film and the remainder fitted only for Vitaphone. But by December, 1928, the number had grown to 1,046 theatres equipped for sound, 1,032 of which could reproduce sound-on-film.

Naturally enough the revolution was



At top, an illustration which accompanied an article in the October 19, 1927, issue of "The Listener In," announcing the commercial advent of the Movietone system. Below is a view inside a 1928 Movietone recording truck, showing the amplifier rack.

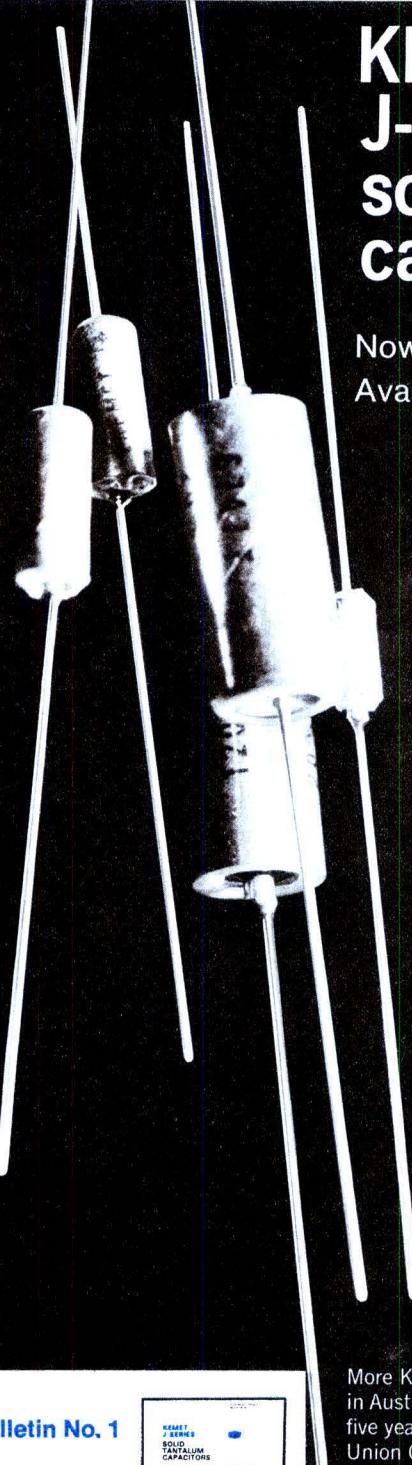
not confined to America, although it was there undoubtedly that it gained the greatest momentum. Similar changes were taking place at about the same time or slightly later in Britain, Europe and even in our own "far-flung" Australia. By June, 1929, a number of Australian theatres were equipped for sound-on-film, a significant proportion of the installations employing sound equipment and amplifier systems designed and manufactured locally by a pioneering young radio engineer named Ray Allsop.

In April and May, 1928 the "Big Five" American production companies — M-G-M, First National, Paramount, Universal and Pathé — signed licensing contracts with Electrical Research Products Inc. (E.R.P.I.), the subsidiary which Western Electric had formed in January, 1927, to handle and commercialise their sound picture and amplification interests. In the months that followed the signing of these contracts there was tremendous activity in building sound studios and commencing production of sound pictures; the

orders for equipment completely swamped the E.R.P.I. manufacturing facilities for most of the remainder of the year.

Understandably, it took some time to build complete new studios, equip them with the necessary facilities and produce full-scale sound pictures. Apart from the usual financial and administrative problems, there were many practical problems of technique to be overcome. The early condenser microphones used were fairly insensitive, and had to be placed sufficiently near the actors to restrict camera angles; yet at the same time the microphones tend to pick up the whirring sound of the camera, so that the latter had to be housed in a clumsy and restrictive enclosure.

Noise from the arc lamps also became a problem, and it became necessary either to fit them with elaborate filtering networks or to scrap them altogether in favour of the less efficient incandescent lighting. There were also problems with the studio buildings, which had to be arranged



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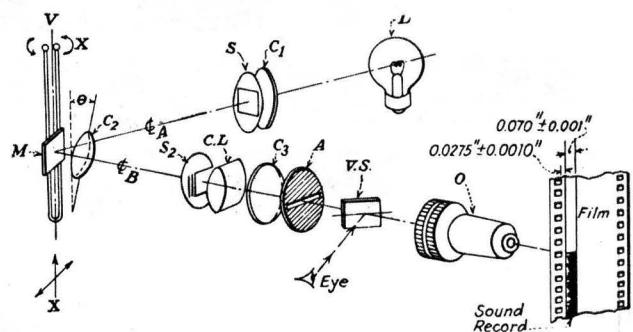
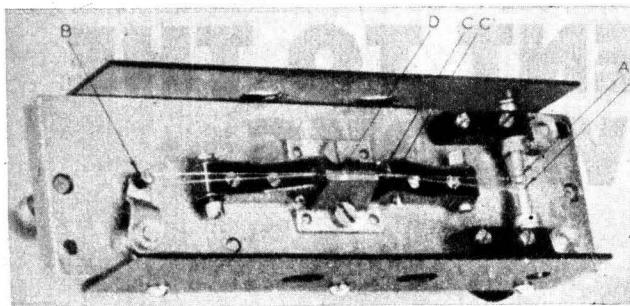
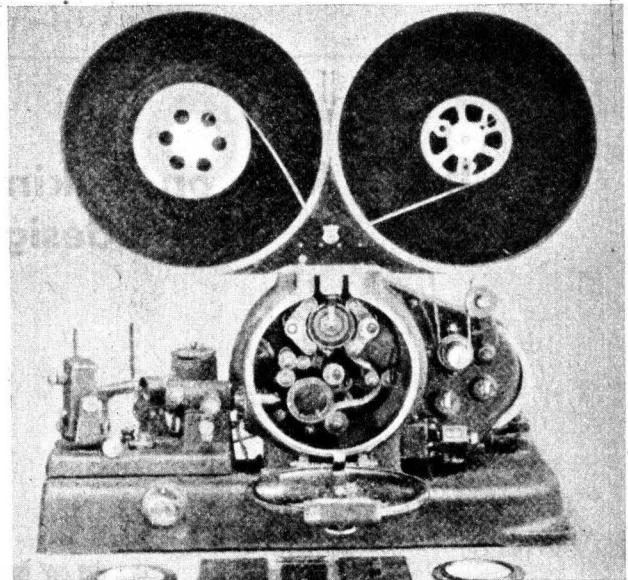
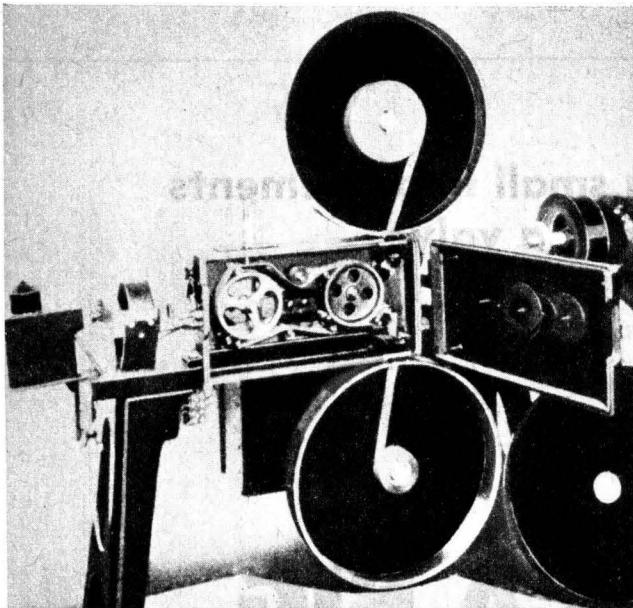
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*Sound recording cameras, 1929 vintage. At upper left is a Western Electric machine, and below is a view of the light-valve modulator; at upper right is an R.C.A. Photophone machine, and below it a diagram showing its optical components. M is the modulator mirror, A the optical slit, and O the final objective lens system.*

to exclude the noise of passing traffic and aircraft while still permitting the occupants to breath!

On June 18, 1928, the first all-sound Movietone program was presented at the New York *Globe* Theater. It consisted of a two-reel dialogue comedy called "The Family Picnic," together with a short called "The Air Circus." In the following month Paramount produced their first part-sound picture, "Warming Up," with Richard Dix, which they recorded using a temporary sound channel. This was followed in September, 1928, by their first all-talking picture, "Interference," directed by Roy Pomeroy. Many of the scenes of these pictures were made at night to avoid outside noise problems.

In October, 1928, R.C.A. acquired the B. F. Keith and Orpheum chains of theatres, together with the FBO Producing Company, and formed a subsidiary which was called Radio-Keith-Orpheum. The "R.K.O. Radio Pictures" produced by this company were to be used to promote the R.C.A. "Photophone" sound picture system which had recently been developed.

In the same month Fox Movietone News releases were increased from one to two issues per week. Then in December, 1928, Fox Movietone released the first all-talking film to be recorded out of doors on location, "In Old Arizona," which was premiered at the Criterion Theater in Los Angeles.

The success of these early sound

films was so spectacular that by March, 1929, Fox announced that all silent film production would be discontinued and future releases would be in Movietone. Most other producers followed suit, so that by the end of 1929 silent film production had virtually ceased.

During this period of rapid commercial development, research was still continuing into ways of improving sound quality. A major problem at the time was the so-called "ground noise," which was a form of noise produced during reproduction as a result of photographic grain, dirt and scratches on the film sound track. Although it was not noticeable during loud recorded passages, it became painfully evident during softer passages, giving the sound channel a low effective dynamic range (typically around 27-30dB).

In November, 1927, Theodore Case had suggested that ground noise could be very much reduced if the average optical transmission of the sound track were arranged to vary according to the mean signal level. He suggested that the required variation in transmission could be produced either by applying an appropriate control signal to the main recording light modulator, or by alternatively using a moving mask or shutter to vary the width of the recording beam. Both suggestions were ultimately to be applied with good results, although it was not until about 1930 that the first of the so-

called "G.N.R." (ground noise reduced) or "noiseless" films appeared.

In 1928, Case and Sponable continued development of the Aeolight lamp, which by this time had become a cold-cathode discharge lamp with rare-earths used to enhance the cathode glow. They succeeded in obtaining both improved results, greater uniformity and longer life. Nevertheless, by the end of 1930 Fox Movietone was forced by financial factors to drop the Aeolight recording system in favour of the E.R.P.I. light-valve system.

At about the same time Warner Brothers finally saw the long-term inevitability of sound-on-film as opposed to sound-on-disc, and dropped the Vitaphone system in favour of the R.C.A. Photophone system. Almost all sound films for the next 15 years were accordingly to be made with photographic sound-on-film, using either the variable-density system championed by E.R.P.I. or the variable-area Photophone system.

The year 1930 also saw developments in microphones; the E.R.P.I. laboratories announced the moving-coil microphone, while at almost the same time the ribbon or "velocity" microphone was announced by R.C.A. Using these microphones in place of the older condenser units, and incorporating the ground noise reduction techniques suggested earlier by Case, the studios were able to produce sound tracks which were improved quite

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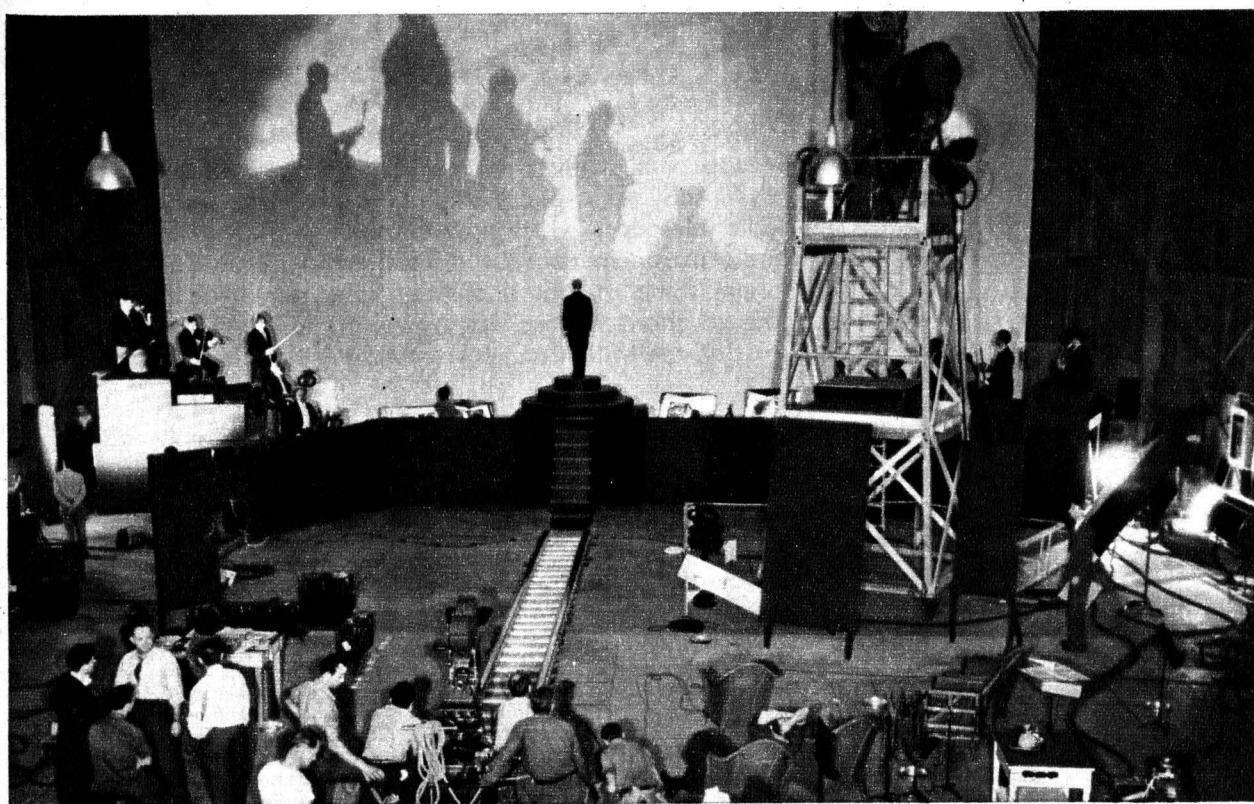
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remarkably over those produced only months previously.

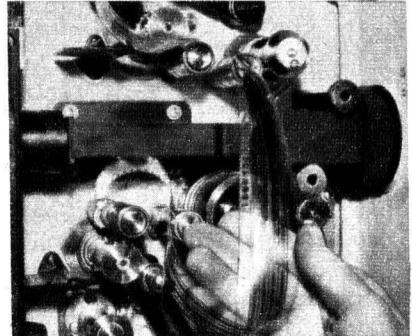
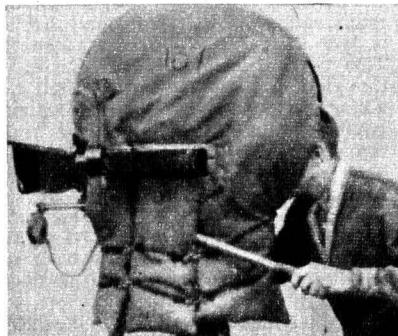
From about 1932 the development of the photographic sound film became largely a matter of cumulative practical refinements in technique and implementation. In 1935 push-pull recording was introduced for prestige releases, giving improved dynamic range and reduced harmonic distortion; however, as modifications were required to be made to the reproducers in the theatres, this development made little impact.

In 1936 an improved printing machine was developed, in which slip-page between the negative and positive films was considerably reduced. This permitted greater detail to be transferred from the negative to positive release prints, and subsequently improved the overall frequency response. It was also discovered at this time that greater detail could be recorded on the negative initially by the use of ultra-violet light in the recording camera.

By about 1938 the basic photographic sound recording system had been developed to a point where its performance was limited mainly by fundamental limitations of the process itself. It was at about this time that the motion picture industry — ever seeking ways to reduce costs and at the same time attract more patrons — started looking around both for ways in which to enhance the basic performance of photographic sound and for possible alternative sound systems.

One idea which had been entertained sporadically almost from the time that the sound picture became a commercial reality was "3-D" or stereophonic sound. As early as 1927 the Bell Telephone Laboratories had experimented with stereo, while in 1934-5 they even produced some sample stereophonic film recordings. Others had continued to experiment

*A shot taken during the shooting in 1940 of Walt Disney's "Fantasia", which was the first film to feature three-channel stereophonic sound. The "Fantasound" system used employed a separate sound film which was recorded and reproduced using special R.C.A. Photophone equipment. (Copyright Walt Disney Productions).*



*At left, a hood used in the early days by Fox Movietone to muffle camera noises. At right is the sound film and reproducer used in the 1940 "Fantasound" system. (Copyright Walt Disney Productions).*

in this field also; at the World Radio Convention in Sydney in 1938, the Australian pioneer Ray Allsop demonstrated a stereophonic sound system which employed a reproducing head based upon that used earlier for push-pull recordings.

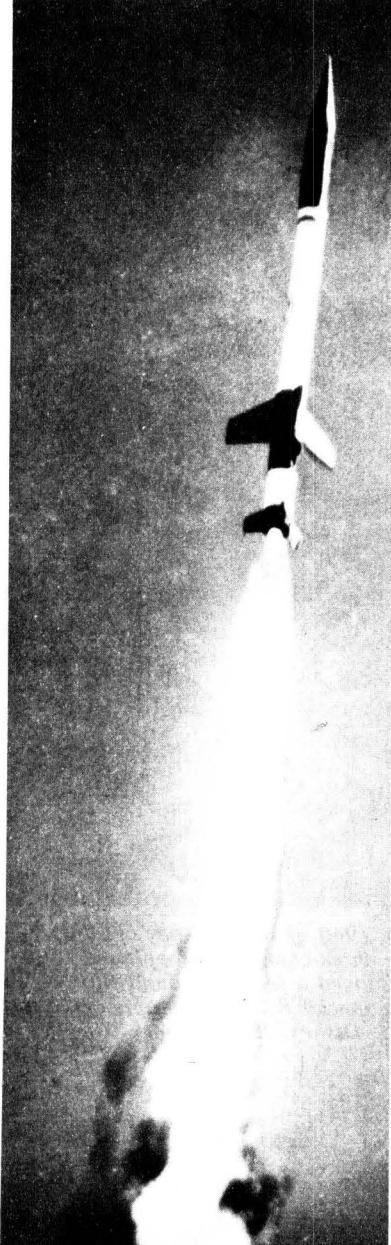
In 1940 came the first really commercial debut of stereophonic motion picture sound, when Walt Disney released his feature cartoon "Fantasia." When released, this film had three-channel sound, the sound recordings being reproduced from a separate film to that carrying the picture. The sound film carried four push-pull tracks in all, the fourth track being used to control the gain of the three main channels for dynamic volume expansion. With three speaker systems behind the screen and up to 96 small speakers placed throughout

the auditorium, Disney's "Fantasound" system was capable of producing quite thrilling effects; however the cost and complexity of the equipment required for reproduction prevented it from becoming popular with exhibitors.

Stereophonic sound reappeared with the advent of wide-screen pictures, notably with the Fox "squeeze"-system CinemaScope and with Reeves' triple-width Cinerama. However, in its modern form it depends upon another and somewhat more significant development in the evolution of motion picture sound — the magnetic sound recording system.

As we noted earlier, the principle of magnetic sound recording was discovered at the turn of the century by the Danish engineer, Valdemar Poulsen. However little work was

(Continued on page 158)



*A Skylark rocket being launched from Woomera, in South Australia. X-ray detectors in the nose cones of these rockets have been checking radiation from X-ray stars.*

# PULSARS AND X-RAY

Newspapers all over the world have carried reports of the mysterious pulse-like signals being received from space on radio telescopes, which have caused much speculation among radio astronomers. First discovered in the northern hemisphere some months ago, they have now been detected in the southern hemisphere by Australian radio astronomers using the Mills Cross telescope at Molonglo Observatory.

The attention of radio astronomers was first drawn to the mysterious pulses from space by a British scientist, Sir Martin Ryle, who heads a team of radio astronomers at Cambridge University. The first announcement concerned a newly discovered radio star which produces a remarkably regular pulsing signal, a sharp burst of radio energy, approximately every 1.3 seconds. Since the first announcement, four more similar stars have been found in the northern hemisphere. Sir Martin Ryle has named these signal sources "pulsars." Quite recently, Australian astrophysicist Professor B. Y. Mills, inventor of the Mills Cross, announced that similar signals had been picked up at Molonglo Observatory.

However, it is the first pulsar discovered by the Cambridge University team which has been studied the most.

The most important thing about this radio source is its very small size; it is less than 3,200 miles in diameter. This makes it smaller than Earth, although it is virtually certain that it is a star and not a planet, since no planet could produce such powerful radio signals and because the source has not been observed to move as a planet would around a star. Before the astronomers became more or less convinced that their new discovery was a star and not a planet, they were unable completely to rule out the thrilling possibility that it might be an artificial radio beacon or a signalling station set up by some super civilisation of extra-terrestrial life forms.

Now, although this idea has (perhaps a little reluctantly) been forgotten, the astronomers are still very excited. If their source — and perhaps the other four like it — really is a star smaller than our planet, then it must be a star which is near to the end of one interesting kind of stellar life history, and no star as near as this to the end of its life has ever been observed before.

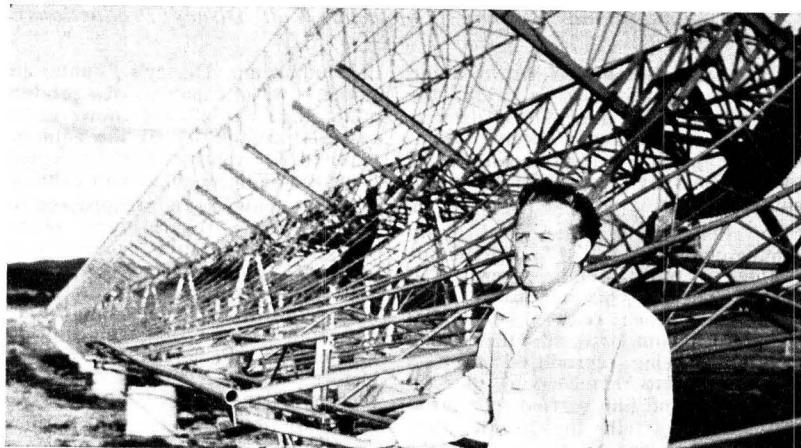
Stars die in different ways; some explode and become novae, a very few undergo a much more violent type of explosion and become super novae, and there are other possible fates. But some stars begin to shrink instead and while many physicist and astronomers have speculated on the fate of shrinking stars, none has ever been observed.

When the hydrogen fuel which sustains a star's H-bomb-like reaction becomes exhausted, then, with no explosive outward force to balance it, the inward force of gravity can cause inward collapse. Altogether, 250 stars are known which have gone nearly to the end of this process. These are the so-called white dwarfs. They are stars, originally bigger than our own Sun, which have shrunk nearly to the size of the Earth, so that their matter has become extremely dense — a matchboxful would weigh nearly a ton. But mathematical theory shows that this should not be the end of the process.

Gravitational forces are powerful enough to squeeze a dying star even closer together, so that its diameter would become a few kilometres only. To make this possible, the electrons which circle the atoms in the star would have to be squashed in, to join up with their opposite numbers, the protons in the nucleus, to form single particles, neutrons, with no electric charge, because the positive charges of the protons and the negative charges of the electrons would have cancelled each other.

No example of these "neutron stars," which are the last stages in the life of stars, has ever been found — until, perhaps, now. The Cambridge star could be small enough to be a neutron star and there are theoretical reasons why such a star might be expected to expand and contract in a regular pulsing way and to produce regular radio pulses.

If this mystery star does turn out to be a neutron star then the physicists will be pleased because their theoretical predictions will have been confirmed by observations. The next step will be to try to find what happens if a star shrinks even further. Some



*Dr. B. Y. Mills alongside the east-west arm of his Mills Cross radio telescope at Hoskintown, near Canberra, A.C.T. This radio telescope was the first to detect "pulsars" in the Southern hemisphere.*

# STARS

## Radio astronomers puzzled by strange signals from space

astronomers believe it would vanish altogether, and reappear in a different part of the universe, defying the normal laws of space and time. Shrinking stars may hold the key to a continual rebirth of the universe.

It is possible that astronomers may one day be watching when a shrinking star winks out like a blown-out candle, as space and time in its vicinity become so distorted by its immense gravitational pull that no radiation of any kind can any longer escape from it. After this point, no mathematician can really predict what will happen, because besides the star becoming invisible everything turns topsy-turvy. It has even been suggested that inside a star which has shrunk beyond a certain size time could run backwards and atomic particles could travel faster than light. Certainly, very strange things must happen. That is why astronomers everywhere are so excited, because Professor Ryle and his colleagues appear to have gone one big step further in tracking the life history of a shrinking star down towards the point where it starts to defy the normal physical laws.

Since the ticking stars, as they have been christened, were first discovered, they have excited more interest than any other astronomical discovery since the quasars. Several different theories have been put forward to explain their nature. One is, that each source is actually a double star, with the two members of the pair rotating around each other. According to this idea, each star would act as a sort of gravitational lens on the radio pulses from the other, focusing them into a tight beam. This beam would sweep past the Earth at regular intervals like the beam from a lighthouse and, like a lighthouse beam, it would sweep over the Earth at regular intervals. Another suggestion is that each source is a single star, but one which only gives out radio pulses from certain parts of its surface and which is spinning rapidly. This too would produce the same effect as a lighthouse beam. Still other theories are being put forward every week and it is difficult to keep up with the latest ones. What is certain is, that the discovery of Professor Martin Ryle and his colleagues is going to add something new and important to our knowledge of the universe, because this has always been the way with new classes of object discovered in the heavens.

Another mysterious signal source from space is the so-called X-ray star. Australia has played a major



*Sir Martin Ryle, Professor of Radio Astronomy at Cambridge University, and discoverer of "pulsars."*

role in the investigation of these objects and the signals they produce. The subject of X-ray astronomy shows signs of becoming a science in its own right, in the same way that radio astronomy has become a separate branch of activity from optical astronomy.

X-ray astronomy has now reached about the same stage of advancement as radio astronomy had reached around 1950. Many astronomers believe we may eventually learn as much about the universe from X-ray stars as we have from radio stars. Unlike radio waves, X-rays do not penetrate the atmosphere, and so it is necessary for research to be carried out by instruments sent above the atmosphere by rockets.

Most British observations have been made from X-ray detectors mounted in the nose cones of Skylark rockets. Last April, one in a series launched from the Australian range at Woomera, located a new powerful X-ray source in the heavens. As only some 30 X-ray sources have been found so far, the new one was the subject of special interest, but by the time a third rocket was launched to look at it, only a matter of three weeks later, it had become much weaker. By September it was only just detectable, and now it has disappeared completely. Astronomers calculate that this X-ray star could only have been giving X-rays at all for about two years. This is an astonishingly short length of time for any important stellar process. Big changes in stars normally take thousands of years. This one may cast a completely new light on the evolution of stars.

One theory of the nature of X-rays stars is that they may be double stars, partners who swing round each other, only a million miles or so apart. From time to time, so the theory goes, the partners stray too close together and the gravitational pull of one strips the outer layers off the other, exposing its super heated heart. Very high temperatures are required to produce intense streams of X-rays; the exposed part of the star would provide them. Another recent theory is that X-ray sources are novae or exploding stars.

One X-ray source which has been located, in the constellation Centaurus, may be a supernova, a much less common and more violent type of explosion. Another possibility is that the X-ray sources represent collapsing stars which have shrunk. In shrinking they would be heated to several million degrees Centigrade, enough to produce torrents of X-rays. These collapsing stars are very hard to observe and if they exist, which is still not certain, then they are one of the most important phenomena in the universe. This is one reason why astronomers are so anxious to observe them. Another is that X-ray sources have all been found so far in those parts of the Universe with a preponderance of very young visible stars and of the clouds of hydrogen gas from which it is believed stars are born. So there may well be some link between the X-ray source and the birth as well as the death of stars.

At the moment there are too many theories and not enough facts, but the facts are beginning to come in. One important field of X-ray astronomy is concerned with the Sun, a relatively weak but conveniently close source. Eight Skylark rockets, launched from Woomera, have already carried X-ray telescopes trained on the Sun. The American Orbiting Solar Observatory, OSO 4, launched last October, carried an X-ray telescope contributed by University College, London. Another similar instrument travelled on the first British satellite, Ariel 1, and another British instrument will be orbited when the next attempt is made to launch the first European satellite, ESRO 2. An elaborate British X-ray telescope will travel on the third American astronomical observatory when this is launched. The next all British satellite, Ariel 4, may carry an array of X-ray telescopes. Meanwhile the British Aircraft Corporation is providing a new series of Skylarks, which are carrying payloads provided by Australian universities as well as British instruments from the University of Leicester and elsewhere. British astronomers are very well aware of the importance of this new field and they are determined to remain among the leaders.

# SOUND LEVEL METERS TO ENFORCE U.K. NOISE LAWS

Police equipped with noise level meters will soon be in action on the roads of Britain to enforce new regulations which came into effect on July 1, limiting the amount of noise which may be emitted by various classes of motor vehicles.

by Harry Tyer

Although regulations forbidding excessive noise from motor vehicles have existed in Britain since 1917, the law, with its successive amendments, has not been capable of proper enforcement by the police because of the lack of precise definition of just what constitutes "excessive" noise.

New regulations laid before parliament some months ago by the Minister for Transport, Mrs Barbara Castle, set the following legal limits for motor vehicle noise from July 1, 1968: Motor cycles under 50cc — 80dB; other motor cycles — 90dB; passenger cars — 87dB; light goods vehicles — 88dB; heavy vehicles — 92dB. The reference level of 0dB is a pressure of 0.0002dyne/cm<sup>2</sup> and 1dB corresponds to the threshold of audibility for a person with normal hearing. The figures have been drawn up on the basis of noise normal for each class of vehicle currently in use, fitted with appropriate mufflers and in otherwise good mechanical condition.

The regulations are designed to alleviate the present noise position by ensuring that vehicles already on the road do not cause unnecessary noise through faulty exhaust silencing systems or mechanical vibration. However, the legislation is intended to lead to an eventual and positive reduction in vehicle noise. To this end, all vehicles registered on or after April 1, 1970, will have to be constructed so that they do not exceed the following noise levels, when tested AT FULL THROTTLE: Motor cycles under 50cc — 77dB; motor cycles under 125cc — 82dB; motor cycles over 125cc — 86dB; passenger cars — 84dB; light

goods vehicles — 85dB; heavy vehicles — 89dB.

All measurements are taken using what is known to acoustic engineers as the standard "A" weighting curve, over the range 31.5Hz to 8KHz. An instrument incorporating this weighting curve has its frequency response modified so that it approximates the frequency response of human hearing under similar conditions. Measurements specified by the new regulations are therefore quoted in "dBA."

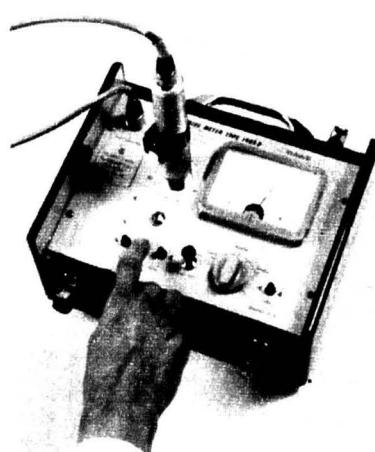
Britain thus becomes the first country to introduce effective legislation designed to control a problem which has been increasing in magnitude with each passing year. Resentment among the public had led to the formation of the Noise Abatement Society, dedicated to the reduction of ambient noise in all its forms; and the medical profession has not been backward in pointing out the ill-effects of high ambient noise levels — ill-effects such as loss of efficiency or, more seriously, diagnosable bodily disorders.

In 1960, the then British Government set up a committee under Sir Alan Wilson "to examine the nature, sources and effects of the problem of noise and to get advice on measures to mitigate it." The terms of reference of the Wilson committee were wide, but its report, published in 1963 after an exhaustive examination of the situation, showed that the major source of noise which disturbed people in the home was road traffic. Its investigations also led the committee to the conclusion that road traffic noise was increasing at the rate of 1dB a year — that is, it was doubling every three years.

The committee recommended that legislation be introduced to limit vehicle noise but pointed out that, before this could be done, standard measuring equipment and methods of test would have to be available to enable the law to be enforced.

Even before the Wilson Committee published its report, extensive tests on meters and methods of measuring vehicle noise had been carried out in Britain. Among those studying the problem were the Ministry of Transport, the National Physical Laboratory and the Motor Industry Research Association. Studying the design of noise measurement meters in a private capacity was the scientific instrument company Dawe Instruments Ltd.

In 1962, the British Standards Institute issued British Standard 3425, "Method for the Measurement of Noise Emitted from Motor Vehicles." This outlined testing conditions to obtain consistent and reproducible measurements. In the same year, the Institute published British Standard 3529, "Sound Level Meters for the Measurement of Noise Emitted by Motor Vehicles."



ABOVE: The indicator and control unit of the Dawe Noise Meter Type 1409D. The button in the bottom right corner increases the sensitivity by 10dB for checking background noise level.



LEFT: The noise meter set up for roadside tests.

**IF THERE'S A BATTLE OF THE COMPACTS . . . THE CELESTION "DITTON 10" IS WELL TO THE FORE**

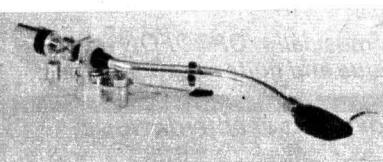
Many music lovers require compact speaker systems . . . and tape recording enthusiasts find the addition of external speaker systems makes an astounding difference to performance. Although only 12 in. x 6½ in. x 8½ in. the "Ditton 10" incorporates two units, the bass reproducer being a specially designed "long throw" model which extends LF response. Power handling capacity is 10 watts R.M.S. Both 3 and 15 ohm impedances are available . . . the 3 ohm model is ideal for use with solid state amplifiers and tape recorders. See the reviews in "Hi-Fi News", p. 433, Oct., '65, and the "Gramophone", p. 41, June, '65. Write for copies of these enthusiastic reports. The "Ditton 10" is beautifully finished in teak or walnut veneers. These compact systems are used by one of Australia's leading universities to reinforce sound in the auditorium. Including Sales Tax . . .

**\$59.00**

**RAPIER SOLID STATE TUNERS**

A high quality AM tuner, the Rapiers represents outstanding value. Output suits all amplifiers and tape recorders. The external teak finish case is optional. Price with case is \$46.50 inc. sales tax. Encel price without case is only . . .

**\$43.60**



**NEW HIGH QUALITY TONE ARM FROM ENCEL ELECTRONICS!**

The new Nikka-Lustre Model ST510 is the successor to the well proven Model CP3. Thousands of these fine arms were sold all over Australia. Now the improved model at the old price is better value than ever. Model ST510 is priced at \$19 inc. sales tax and the Model ST510D (with lifting/lowering device) is priced at only \$24.50. Ask for full details. From . . .

**\$19**

**LOW PRICED DYNAMIC MICROPHONE—IDEAL FOR TAPE RECORDERS!**

The Piezo DX75 is a robust dynamic microphone which is small in size and quite unobtrusive. Dual impedance is 50 ohms and 50K ohms. Encel price inc. sales tax, only . . .

**\$6.90**

**COMPLETE ENCEL STEREO SYSTEM FOR ONLY \$179!**

We supply the popular Sound Model SAQ203 stereo amplifier with magnetic sensitivity and an output of 12 watts R.M.S. or 30 watts E.I.A. peak power (total), the new Compax belt-driven turntable, a high quality tone arm with lifting/lowering device, the Shure Model 44G or Micro 3100/5 magnetic stereo cartridge with diamond stylus and a matched pair of Sonics Model AS-60E multiple speaker systems. Each enclosure is hand finished in teak/walnut veneer. Total Encel price, inc. sales tax, is only . . .

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**REPLACEMENT DIAMOND STYLUS FOR MOST STEREO AND MONO CARTRIDGES**

A replacement stylus for your cartridge can cost as little as \$2.50 when you buy from Encel Electronics. Correct replacements are available ex-stock for the majority of popular cartridges.

**DRAMATICALLY EFFECTIVE TAPE STEREO SYSTEM WITH A TUNER/AMPLIFIER FOR ONLY \$415**

Encel Electronics supplies an Akai Model 3000D stereo tape deck with three heads and silicon transistor circuitry, the Compax Model CE-5000 stereo tuner/amplifier with an output of over 80 watts IHFM, a matched pair of Sonics Model AS-61 speaker systems. Each hand finished teak/walnut enclosure houses 4 bass/mid-range speakers and a high frequency speaker. Encel price inc. sales tax

**\$415**

**ENCEL SERVICE DIVISIONS**

Modern and efficient service centres operate in Sydney and Melbourne. Up to the minute servicing equipment is provided and skilled technicians who have been specially trained actually save you money when service is necessary as time expended is kept to a minimum. Encel service does not cost — it pays.

**WHARFEDALE SPEAKERS**  
See the complete range of famous Wharfedale speakers and speaker systems . . . ask for an EMQ or a trade-in valuation, as we are not permitted to advertise prices.

**NEW SOUND MODEL SAQ-203 STEREO AMPLIFIER—\$69.50**

Frequency response is 30-20,000 Hz. and input sens. suits magnetic cartridges at 3 mV. Output is 12 watts R.M.S. or 30 watts E.I.A. peak power. 18 low noise transistors, headphone jack, all necessary controls. Inc. sales tax . . .

**\$69.50**

**SONICS STEREO 'PHONES—\$12.50**  
Model HS-304 Sonics stereo headphones are very comfortable and offer fatigue free listening on a personal basis. Wide frequency response and remarkable stereo presence . . .

**\$12.50**

**NEW 8" CO-AXIAL SPEAKER WITH SEVEN POWERFUL MAGNETS AND UNIQUE NEW DESIGN—\$34.50**

The new CX-20D is the result of a revolution in speaker design combined with precision engineering. A horn type tweeter is used . . . a three inch voice coil . . . an electrical crossover . . . and weight is almost 8 lbs. Frequency response is substantially flat between 35-23,000 Hz. Cabinet specifications available . . .

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**DEMAGNETISE YOUR TAPE HEADS AND IMPROVE TAPE PERFORMANCE!**

Simply plug the tape head demagnetiser into any AC power point and pass over the heads. Takes only five seconds and can make a world of difference. Two models—single and double probe. Both . . .

**\$3.90**

**SOUND MODEL SAQ-505X — HIGH OUTPUT STEREO AMPLIFIER FOR ONLY \$119.50**

With an output of 25 watts R.M.S. in each channel into an 8 ohm speaker load, the 505X offers a frequency response of 20-20,000 Hz. plus or minus 1 dB. Sens. is 3 mV. All normal controls provided. Inc. sales tax . . .

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**SHURE CARTRIDGES AT ATTRACTIVE ENCEL PRICES**

All cartridges are brand new and Encel prices include sales tax. All Shure cartridges are fully guaranteed.

Model M44G—Retail \$26—Encel \$17.50.

Model M55E—Retail \$49—Encel \$29.50.

Model M75E—Retail \$69—Encel \$42.50.

Model V15E Mk. II—Retail \$118.75—Encel \$74.50

**REVOX G36 STEREO TAPE DECKS**

Three motors are featured in this versatile two speed professional quality stereo recorder. Ask for an EMQ or for an Encel trade-in valuation. Save hundreds of dollars!

**BIG VALUE COSMOS STEREO AMPLIFIERS**

With an output of 8 watts R.M.S. or 15 watts IHFM in each channel the Cosmos SW-30C has a wide frequency response and is attractively priced at \$74.50 inc. sales tax. Ideal for use with tape decks and sensitivity suits magnetic/crystal cartridges

**\$74.50**

**THE NEW ORTOFON S-15 AND SL-15 STEREO CARTRIDGES AVAILABLE AT ALL ENCEL STEREO CENTRES!**

World wide acclaim provides significant testimony to the outstanding performance of the new Ortofon S-15 and SL-15 series. Ask for an EMQ or a trade-in valuation.

**CONNOISSEUR STEREO CARTRIDGE — ONLY \$10.80!**

Designed to load any amplifier or tape recorder, the Model SCU-1 is regarded as the finest ceramic stereo cartridge ever produced. Ask for copies of reviews. . .

**\$10.80**

**AKAI RECORDERS**

All Akai models are now in stock . . . M9, X5, 3000D, X150D, X355, X300 and 1710. Ask for an EMQ.

**COMPLETE ENCEL STEREO SYSTEMS**

Make your choice from the greatest range of equipment and cabinets when you select your new Encel Stereo System. Prices are the lowest in Australia.

**MICRO DUST PICKUPS—\$3.50**

An effective automatic record cleaner which removes dust as the record plays. An ideal gift. \$3.50 inc. sales tax.

**GRACE TONE ARMS . . . FOR THE PERFECTIONIST!**

Two models of this sophisticated arm are available . . . the 12" G-540L and the 14" G-560L. A gimbal type gyroscopic bearing is used — and the Grace arm will track suitable cartridges down to 1 gram with ease. A super light-weight head shell is supplied. Since this arm became available at Encel Stereo Centres many fastidious enthusiasts have traded much more expensive arms of Continental origin. Encel prices inc. sales tax . . . G-560L \$42.50. G-540L \$42.50. P.S. Grace cartridges arrive soon!

**\$34.50**

**MICRO TONE ARMS OFFER OUT-STANDING VALUE!**

Designed to track effortlessly with the most sensitive and delicate cartridges, Micro arms accept SME and ORTOFON head shells without modification. The Micro head shell accepts any standard 1" mounting cartridge. Vertical and horizontal movement is almost friction-free — tracking pressure is adjustable from 0.5 grams. Model MA88 (16") is priced at \$35.50. Model MA7 (14") is only \$29.50. Encel prices include sales tax.

**SEE ENCEL STEREO CENTRES FOR THE COMPLETE RANGE OF SANSUI AMPLIFIERS!**

Sansui tuner/amplifiers are extremely popular in Australia. Models 220, 500A, 1000A and 3000A are now in stock — and the prices are most attractive. Ask for an EMQ or a trade-in valuation on your old equipment.

**NEW TONE ARM LIFT . . . THE COLTON "VARILIFT" ONLY \$9.50!**

Fitted with a cranked lifting arm and push-button control the Colton "Varilift" is hydraulically damped; operation is particularly smooth. Rate of descent is adjustable. Fits all tone arms. Ask for copies of review. Inc. sales tax . . .

**\$9.50**

**SEE ENCEL'S SOON FOR YOUR NEW STEREO TAPE DECK!**

Included in the wide range of stereo tape decks at Encel Stereo Centres you will find the Akai 3000D and X150D, the Revox G-36, the Tandberg Model 6-4X, National decks and also models from Toshiba. Ask for an EMQ or a trade-in valuation.

**LOWTHER LOUDSPEAKERS FROM ENCEL ELECTRONICS!**

The well-known Lowther Model PM6 (17,500 lines) is now available on immediate delivery. Write for EMQ's or call for your personal quotation. Cabinet drawings available on request.

**SAVE YOUR RECORDS . . . USE THE UNIVERSAL NIKKA-LUSTRE TONE ARM LIFT!**

This beautifully finished and functional universal tone arm lift will fit all tone arms . . . the lowering action is pneumatically damped and extremely smooth. Risk of record damage may now be eliminated. Including Sales Tax . . .

**\$8.50**

**COMPLETE ENCEL STEREO SYSTEMS**

The Encel organization has installed thousands of Encel Stereo Systems in Australian homes. Cabinets are carefully handcrafted — you make your selection from the most extensive range of audio equipment available in Australia.

**HIGH FIDELITY STEREO 'PHONES COST LESS AT ENCEL ELECTRONICS!**

Several wide range stereo headsets are now available including the new model Sonics HS-304. This headset is very comfortable and response is extremely good over the complete sound spectrum. Price is \$12.50; a bargain basement cost for a headset of this calibre. From Sweden comes the Pearl 'phones . . . made by P.M.L. These 'phones are particularly sensitive and are high impedance (400 ohms). Fitted with ear muffs for long periods of fatigue-free listening. Pearl price \$19.50. Sonics HS-304 \$12.50 including Sales Tax.

**CASSETTE RECORDERS**

If you're looking for a cassette type recorder, write or call at your nearest Encel Stereo Centre for an EMQ. We are not at liberty to reveal the current cash prices for popular cassette recorders through advertising.

**NEW MODEL MICRO STEREO CARTRIDGE**

The new Model 3100/5 and 3100/E (with elliptical stylus) stereo cartridges have now been released. An outstanding performer, the "3100 series" is also impressive by virtue of its low price. Ask for EMQ's.

**ENCEL ELECTRONICS (STEREO) PTY. LTD.**

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# ONLY A FEW MAGNETIC STEREO CARTRIDGES EARN PLACES IN THE SUPERLATIVE BRACKET.

## ORTOFON HEADS THE LIST.

Most reviewers have several favorite cartridges — *in most cases, ORTOFON heads the list.*

The explanation is a simple one. ORTOFON is the only organization in the world manufacturing professional disc cutting equipment and cartridges for playback. Many of your favorite recordings will be reproductions from ORTOFON cut masters! As reproduction is complementary to recording it naturally follows that ORTOFON should produce the finest arms and cartridges available in the world today.

ORTOFON cartridges have won universal popularity with discerning music lovers and professional users; the low distortion moving coil principle is quite incomparable. Stereo cartridges developed by ORTOFON engineers have always been advanced in design and construction; the ORTOFON S15 series offers superior sound reproduction and will trace the most complex waveforms at 1.5 grams. The S15 is available with an optional built-in transformer and may also be purchased ready mounted in the lightweight metal "G" shell for use with the ORTOFON SMG-212 tone arm.

\*An exclusive protective device . . . "Protecto-Skate" . . . shields the stylus if the cartridge is accidentally subjected to excessive external lateral, or vertical pressure. This tube is highly polished to afford added protection for the record surface itself.

ORTOFON now introduce the new SL15 lightweight stereo cartridge — a moving coil unit with very high compliance and improved frequency response. This superb cartridge is designed for use in transcription tone arms of the highest possible calibre.

#### ORTOFON TRANSFORMER MODULE

A twin transformer module which may be fitted anywhere in the lead between the tone arm and the amplifier is now available, complete with plugs and cables.

Specifications: Input impedance — 2 ohms. Output impedance — 15 Kohm. Load impedance — 47 Kohm. Frequency response — 10-40,000 Hz.

#### THE NEW ORTOFON TONE ARM MODEL RS-212

Full advantage of the outstanding characteristics of the SL15 series cartridge may be taken with the new ORTOFON RS-212 arm. A stylus pressure mechanism based on spring tension also incorporates an effective automatic anti-skating arrangement; stylus pressure and anti-skating force are correctly related when the stylus pressure is set. Although factory set for ORTOFON cartridges with elliptical stylus, a ratio adjustment screw permits use of any cartridge. The ORTOFON "Hi-Jack" lifting/lowering device is standard equipment with the RS-212 arm.

The ORTOFON moving coil principle is the only recognised transducer system inherently free of non-linear distortion, tracking distortion caused by the differing shapes of cutting stylus and reproducing stylus has now been eliminated by ORTOFON thanks to the use of exclusive ORTOFON elliptical diamonds. All ORTOFON cartridges feature a 15° tracking angle.

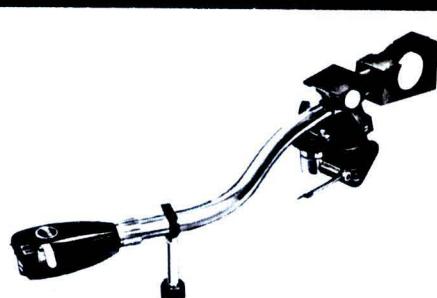
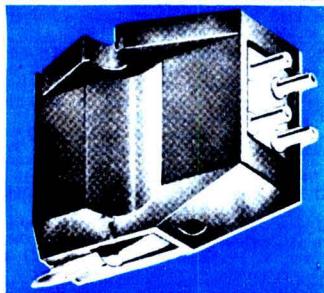
Technically and musically ORTOFON stereo cartridges are unique and quite superior.

#### ORTOFON S15 SPECIFICATIONS:

	S15T	S15
Weight of cartridge	18.5 grams.	12.5 grams.
Output impedance	15 Kohm	2 ohm
Output in mV/cm/sec (loaded)	2	0.04
Equivalent mass at stylus point	0.9 mg.	0.9 mg.
Recommended stylus pressure	1-2 gr.	1-2 gr.
Elliptical stylus radius	0.0007" x 0.0003"	(both models)
Spherical diamond radius	0.0006" (both models)	
Tracking angle	15°	15°
Static compliance	20 x 10 <sup>-6</sup> cm/dyne	
Frequency response	15-40,000 Hz.	
Channel separation	20-30 dB.	

#### ORTOFON SL15 SPECIFICATIONS:

Weight of cartridge:	7 grams.
Output impedance:	2 ohms.
Equivalent mass (at stylus point):	0.9 mg
Recommended stylus pressure:	0.75-1.5 grams.
Output:	0.025 mV/cm/sec.
Stylus radius:	Spherical diamond—SL15 0.0006".
Stylus radius:	Elliptical diamond — 0.0007" x 0.0003".
Tracking angle:	15°.
Static compliance:	25 x 10 <sup>-6</sup> cm/dyne
Channel separation:	20-30 dB.
Frequency response:	10-40,000 Hz.



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W.A.: Athol M. Hill, 613-615 Wellington Street, Perth. Tel. 21 7861

These standards were intended to form a basis for traffic noise legislation, but the problems of roadside measurement and the need for international agreement delayed the introduction of such legislation for six years. In 1964, the International Standards Organisation published Recommendation 362, "Method for the Measurement of Noise Emitted by Motor Vehicles." The British Standard required modification in some aspects of detail to bring it into line with the I.S.O. recommendation, and an amended British Standard was issued in 1966. It is this standard which has been used for the basis of the legislation laid before the British Parliament earlier this year, which came into force on July 1.

The British Standard lays down precise conditions for carrying out tests for vehicle noise. In addition to the performance of the meter to be used, it specifies the acoustical environment, taking into account such factors as the test site, sound absorption, reflection from surrounding structures, and wind. The testing ground must be substantially level and the surface such as not to cause excessive tyre noise. The measuring conditions and the distances to be observed are laid down and allowable tolerances are quoted.

With the regulations now in force, Dawe Instruments Ltd. has put into production its Noise Level Meter Type 1409D. The instrument has been designed to allow tests to be carried out in accordance with Ministry of Transport requirements and also conforms to British Standard 3539. It consists of a ceramic microphone, high gain amplifier, weighting network, attenuator and taut band meter. The microphone with internal pre-amplifier measures 6-3/8in long by 1-1/8in diameter, and is supplied with a collapsible tripod. The instrument case containing the other circuit elements and batteries measures 10-1/2in x 10in x 7in. The whole unit is therefore entirely portable.

At a test site at the Brands Hatch racetrack, Dawe Instruments recently demonstrated its equipment to interested parties and the Press. The tests involved a number of different types of vehicle, ranging from a Rolls-Royce Silver Cloud to a Morris 2-ton van. Motor cycles were also used, and some vehicles had two examples, fitted with faulty and normal mufflers. Not surprisingly, the Rolls-Royce topped the performance, with a reading of only 62 and 63dBA, when checked at 30 m.p.h. The readings on most other cars was within the range 68 to 70dBA.

To give these figures some kind of perspective, it is worth quoting figures for typical noise levels quoted by the Wilson Committee report. A soft whisper at 5ft was quoted as 34dB, a typing pool with nine typewriters as 65dB, a vacuum cleaner at 10 feet as 69dB and loudly reproduced orchestral music in a large room as 82dB.

To initiate the regulations, the Ministry of Transport declared an amnesty period, during which officers of the Ministry held roadside checks and advised owners of offending vehicles that they were not conforming with the requirements of the law. Prosecution will begin as police officers who have been trained in the use of the equipment begin operating on the roads of Britain. ■

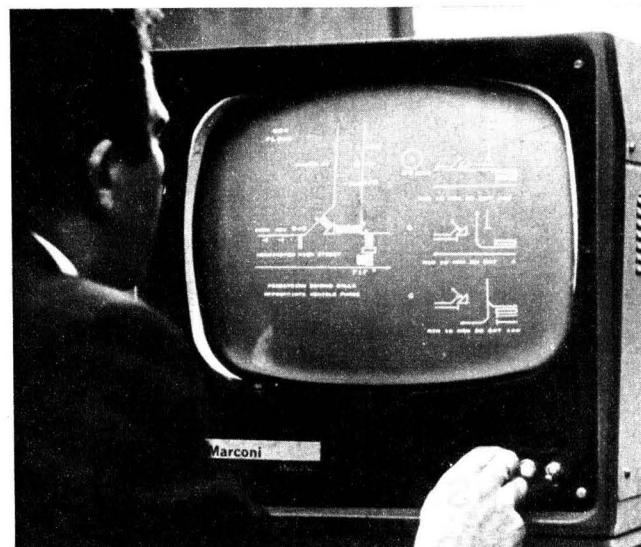
## Computer Traffic Control in London

A Marconi Myriad 11 computer has been ordered by the Greater London Council to extend existing Ministry of Transport experimental facilities for the computer control of road traffic in West London.

The computer will be used with a specially developed display system to provide operators in the existing control centre at New Scotland Yard with additional information on traffic conditions at any of the road intersections under control.

The new system will display map-type plans of any section of the street network under control, selected by the operator, on TV type monitor screens. Street names, pedestrian crossings, the location of traffic detectors and other essential features will be shown as well as continuously up-to-date data on the current traffic situations. Information will be presented in written form on the monitor screens, or as a graphical presentation, as selected by the operator. The installation will also be used to provide routine statistical analysis of the performance of the traffic control system, and for "post mortem" examination of unusual traffic situations.

Information is collected in the first instance by traffic sensors placed at each approach to the computer controlled intersections. Signals from the sensors are transmitted over land lines to the computer centre at New Scotland Yard. Numerical data is first converted to binary form. This data is then fed to the computer which compares the traffic conditions with its prepared programs to decide the operating sequence of traffic lights.



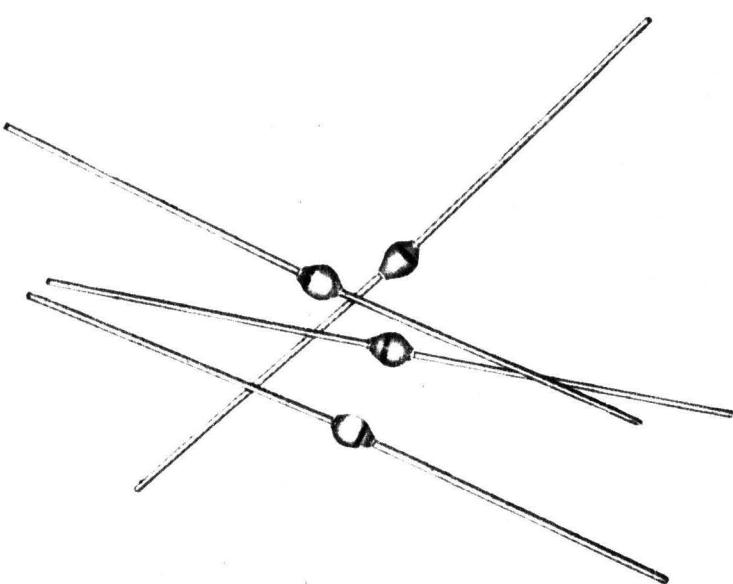
The photograph above shows one of the Marconi Type X2000 graphic displays to be used in the new system, displaying a street network labelled with traffic data. The display is simulating a display of the junction of Kensington High Street and Church Street, in the West London area. Information is being displayed relevant to traffic flow, queue length of vehicles waiting to pass the intersection from each approach, and time taken to pass the intersection from each approach. Pedestrian demand calls are registered as received at pedestrian crossings. Acting upon the data received, the computer controls traffic light sequences to ensure the most efficient traffic flow under the prevailing conditions.

The new Marconi contract represents a second stage of the planned Greater London Council development program for traffic over a very wide area of London, involving hundreds of intersections. Apart from analysis and display, the system will be capable of directly controlling further intersections.

In addition to the Myriad computer and displays, The Marconi Company will supply disc and tape backing stores, tracker ball and keyboard control systems, interface equipment and graphical back-up equipment.

This will be the second Myriad computer to be supplied by The Marconi Company for traffic control purposes. Last year, the company supplied a similar unit for an area traffic control system operating at 80 intersections in the centre of Glasgow, Scotland. Over the first year of operation, the system has functioned with only one minor processing failure.

# New Ideas in Electronics



A 1.0-amp rectifier  
that dissipates 1000w  
in reverse  
direction without  
heat damage

The General Electric A14's ability to dissipate up to 1000 watts in reverse direction without heat damage means there is no worry of surface breakdown during absorption of household and industrial voltage transients.

Securely sandwiched between two heavy thermally-matched slugs, the 1.0-amp A14 pellet is protected from transient voltage heat. Its PN junction goes into reverse power safely throughout the bulk of the silicon pellet and preventing localized heating at the perimeter. You get high surge current capability and low thermal impedance, too.

Additional product features include:  
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# Technical Review

## Liquid crystals could introduce a new technology

A number of experimental liquid-crystal devices that could lead to potentially important new electronic products were recently demonstrated to the press by RCA Laboratories. The devices included an all-electronic clock with no moving parts and a high-resolution picture display.

Dr George H. Brown, Executive Vice-President, Research and Engineering, said that the new technology may have a profound effect upon the long-range growth of the electronics industry by altering many present techniques and opening the way to entirely new ones. "The liquid crystal display gives promise for the first time of a practical thin-screen competitor to such vacuum-tube displays as the oscilloscope used in radar, the 'Nixie' tube used to display changing letters and numbers, and, perhaps eventually, the picture tube used in television sets," said Dr Brown.

The liquid crystals are inherently inexpensive, their power requirements are extremely small, and they lend themselves to use in conjunction with solid-state and integrated circuitry. Since liquid crystal displays are read by reflected light, in the manner of a book, rather than from their own emitted light, as in television, a picture on a liquid-crystal device will gain in brightness as its surroundings become brighter. Therefore, it could be viewed even in bright sunlight.

Development of the new liquid-crystal screen resulted from the application of two discoveries, namely, that certain liquid crystals can be made opalescent and hence reflective by the application of an electric voltage; and that the temperature range over which this occurs — originally confined to only a few degrees at high temperature — can be expanded with new materials to cover a range from below freezing to the boiling point of water.

The developers described liquid crystals as organic compounds whose appearance and mechanical properties are those of a liquid, but whose molecules tend to form into large, orderly arrays akin to those that make up such solid crystals as mica, quartz and diamonds. They gave the following description of the new display technique:

A sandwich is formed of two clear-glass plates separated by a thin layer of clear liquid crystal material only one thousandth of an inch thick. A reflective mirror-like conductive

coating is deposited on the inside face of one plate, in contact with the liquid. On the inside of the other plate is deposited a transparent, electrically conductive coating of tin oxide.

When a potential difference is applied between the two coatings, the liquid crystal molecules are disrupted and the sandwich takes on the appearance of frosted glass. The frostiness disappears, however, as soon as the charge is removed.

In order to display stationary patterns such as letters, symbols, numerals (as in the liquid-crystal clock), or still images, the coatings are shaped in the desired pattern. To display motion, the conductive coatings are laid down in the form of a fine mosaic whose individual elements can be charged independently, by a scanning signal such as is used for facsimile, television or other electronic displays.

It is also possible to make both coatings transparent and to provide a light source at the edge of the screen in order to make the images or patterns visible even in a dark room or at night. Another possibility is to reflect a strong light from the liquid crystal, enlarging the image many times on a screen or other surface.

The Bendix Corporation in the U.S.A. has also been active in developing liquid crystals and putting them to use. Already, the company has found a way of using them to map electric field intensities, as described in "Electronics" for June 24, 1968, from which the following is extracted:

Liquid crystals are neither liquid nor crystal, but exhibit some properties of both states. At the proper temperatures, the chemicals are somewhat fluid but display the cloudiness characteristic of crystals. They can scatter light of various colours, usually within any range of about 3°C from 0°C to 100°C. The process is reversible, and the crystals are very sensitive to small temperature changes. Changes as small as 0.1° can be detected if a narrow range is used. Thus, the crystals can be painted on surfaces to serve as a precise temperature indicator.

Liquid crystals are usually applied

as a thin coating. The usual procedure is to apply a 10% solution in a fast-evaporating solvent by brushing, flowing, dipping, or dripping. The solvent usually evaporates in about two or three minutes and leaves behind a coating of waxy liquid crystals. As soon as the coating is dry, it displays the colours indicative of temperature.

The sequence of colours within the 3°C range is blue, green, yellow, orange, red, and then back to colourless. Blue indicates the highest temperature and red the lowest.

The first model of the crystal detector consisted of a 6-inch-diameter Mylar membrane stretched over a plastic holder. The membrane was about 0.002 inch thick and had applied to it a thin metalised film that gave the material a resistivity of approximately 400 ohms per square. The liquid crystal solution was sprayed on to the membrane.

The membrane was placed about one inch in front of a radiating X-band waveguide. When the energy radiating from the waveguide was increased to about 20 milliwatts, distinct oval concentric bands of colour appeared on the membrane. The temperature range represented by the transition from blue to red is equivalent to a power spread of 7dB. The shape of the beam's cross section was quite well defined. The concentric bands could be expanded or contracted by adjusting the amount of power from the waveguide. The energy density of the beam's cross section was calibrated by comparing the difference in radiated power to the change in position of a particular colour.

Tests using an X-band focusing antenna from another project further proved that useful information on the shape and position of the beam could be obtained.

The membrane's efficiency can be increased by impedance matching. For essentially plane-wave incidence, the impedances can be matched exactly by using a metal film with a resistivity of 377 ohms per square backed by a plane metal surface placed one-quarter wavelength from the film. This converts all the incident energy to heat. Otherwise, the amount of energy absorbed must be calculated.

Each colour is the result of a specific power density. Calibration can therefore be achieved by making incremental changes in the power and observing the colour transitions. ■

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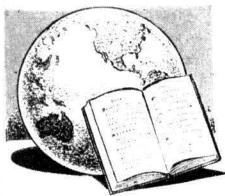
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## GROWING USE OF COMPUTERS IN LAW ENFORCEMENT

Law enforcement agencies in many parts of the world have been using computers for some years, particularly in the U.S.A., where widespread computer networks are operated by State and Federal police. In this article, IBM Industry Representative tells how computers have led to more efficient police operations, and have even saved police lives.

In California a patrolman contacted his dispatcher by radio and described a fleeing car. The dispatcher typed the description and licence number on a data communications terminal teletypewriter, and in a fraction of a second the information was flashed to the California Highway Patrol's central computer system, in which information on stolen vehicles is stored. This data was then automatically compared with descriptions of several thousand "hot cars" reported in the State and its neighbouring jurisdictions.

The computer identified the vehicle as one reported fleeing from a supermarket holdup a few minutes earlier in another county. Within less than a minute the dispatcher had warned the highway patrolman not to stop the getaway car, but to keep it in sight while road-blocks were set up ahead. As a result, the bandits were captured without injury to the police, though two of the holdup men were found crouched in the back seat of the vehicle with guns drawn.

Tracking down armed robbery suspects is only one aspect of police work being aided in a growing number of United States jurisdictions by computer. By giving police rapid access to all of the available information, computer technology is helping to eliminate the lag formerly inherent in spreading "wanted" notices, and even more prosaic data, to those who need it most.

With the population steadily increasing, and the rate of crime jumping even more rapidly, the police are searching for modern tools to combat crime at reasonable cost, without imposing unreasonable restrictions upon the general population.

In the U.S.A., application of computer technology received a major push from the President's Commission on Law Enforcement and Criminal Justice, which recommended in 1967, that police, the Courts and correctional institutions use to the fullest and most recent advances in modern technology among which the computer is conspicuous.

The increasing demand for police services and a broadened scope of police activities has created a number of problems in administering, controlling, and informing police and other law enforcement agencies. The computer, with its capability to store, analyse and retrieve large quantities of information at great speed and low cost, has been a major tool in meeting these demands in America.

In three western States — California, Arizona and Nevada — police are

making joint use of an I.B.M. 7740 data processing system to provide complete, up-to-date, stolen car lists for officers within minutes of an inquiry. More than 12,000 queries are handled each day through 229 local terminals. The central computer itself can handle up to five requests per second.

In operation, the policeman calls in a suspicious licence or description, which is fed to the computer by the local radio dispatcher with a keyboard terminal.

The computer searches its "memory" for a report on the car. The data is printed out at the originating terminal for the dispatcher, who relays the information back to the patrolman via radio.

Known as AUTO-STATIS (Automatic Statewide Auto Theft Inquiry System) this system also provides a "hot car sheet" of the last 270 cars stolen in the three-State area, which can be carried by a local officer, who does not have a radio.

The National Auto Theft Bureau office in San Francisco, as well as insurance agencies in Arizona and Nevada, are linked to the Auto-Stat system network, as are other law enforcement bureaus. Plans are for the network to be connected to the California Department of Justice, to State records of stolen property, to the Federal Bureau of Investigation in Washington, D.C., and eventually to other States.

Through the Auto-Stat system, more than 350 local police departments have been able to entirely eliminate

area stolen-car files. The savings in clerical expense have more than covered the costs of using the computer, with overhead reductions of as much as \$250,000 a year estimated.

The law enforcement agencies have realised these benefits without substantially altering their established procedures in connection with stolen vehicles. With records provided by the computer, local police have been able to dispense with the time-consuming manual preparations of reports to State Highway Patrol headquarters.

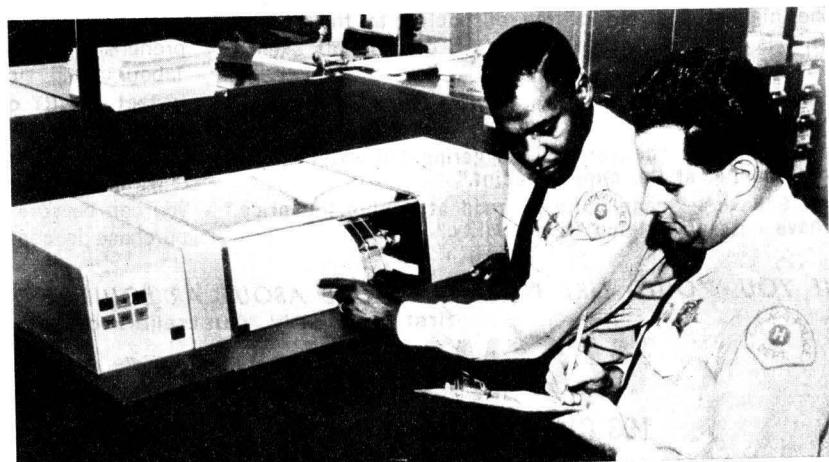
Even where only part of a licence number is reported, the computer can look for an exact match with the remaining numbers. Physical description and other factors can then offer reliable confirmation of the identification.

Likewise, computers can store and retrieve information on wanted criminals, stolen items such as guns, and other data essential to the police. Fingerprints are now matched through laborious manual processes, which can take weeks to complete. Computer classification may soon reduce the time to seconds. Where laws do not permit holding a suspect for long periods of time, quick identification searches could prevent the release of a dangerous criminal.

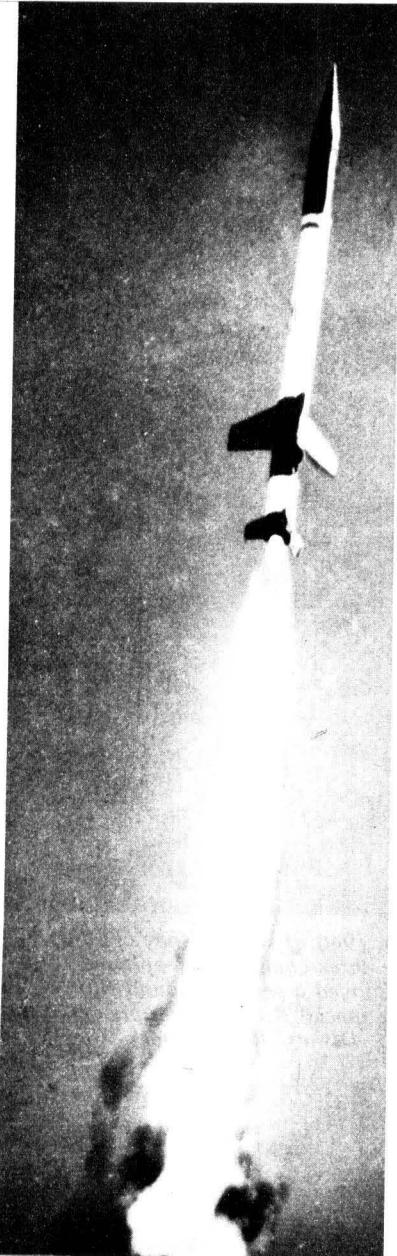
The computer also can be programmed to search for names which sound alike, even though spelt differently, such as "Smith," "Smythe" and "Schmidt." Such a program, using an IBM 360/40 and 360/50, is already in use in the Alameda County Police information system.

The largest law-enforcement computer system in the U.S.A. is the F.B.I.'s National Criminal Information Centre (N.C.I.C.) in Washington.

The N.C.I.C. connects 45 of the 50 States, the U.S. Secret Service, the Royal Canadian Mounted Police, the Army Provost Marshal's office and more than 40 other major police



The widespread computer system of the Chicago Police Department provides detailed information on criminal activity within the city to all local precincts, and can provide data on criminal records, stolen vehicles and similar information in seconds.



*A Skylark rocket being launched from Woomera, in South Australia. X-ray detectors in the nose cones of these rockets have been checking radiation from X-ray stars.*

## PULSARS AND X-RAY

Newspapers all over the world have carried reports of the mysterious pulse-like signals being received from space on radio telescopes, which have caused much speculation among radio astronomers. First discovered in the northern hemisphere some months ago, they have now been detected in the southern hemisphere by Australian radio astronomers using the Mills Cross telescope at Molonglo Observatory.

The attention of radio astronomers was first drawn to the mysterious pulses from space by a British scientist, Sir Martin Ryle, who heads a team of radio astronomers at Cambridge University. The first announcement concerned a newly discovered radio star which produces a remarkably regular pulsing signal, a sharp burst of radio energy, approximately every 1.3 seconds. Since the first announcement, four more similar stars have been found in the northern hemisphere. Sir Martin Ryle has named these signal sources "pulsars." Quite recently, Australian astrophysicist Professor B. Y. Mills, inventor of the Mills Cross, announced that similar signals had been picked up at Molonglo Observatory.

However, it is the first pulsar discovered by the Cambridge University team which has been studied the most.

The most important thing about this radio source is its very small size; it is less than 3,200 miles in diameter. This makes it smaller than Earth, although it is virtually certain that it is a star and not a planet, since no planet could produce such powerful radio signals and because the source has not been observed to move as a planet would around a star. Before the astronomers became more or less convinced that their new discovery was a star and not a planet, they were unable completely to rule out the thrilling possibility that it might be an artificial radio beacon or a signalling station set up by some super civilisation of extra-terrestrial life forms.

Now, although this idea has (perhaps a little reluctantly) been forgotten, the astronomers are still very excited. If their source — and perhaps the other four like it — really is a star smaller than our planet, then it must be a star which is near to the end of one interesting kind of stellar life history, and no star as near as this to the end of its life has ever been observed before.

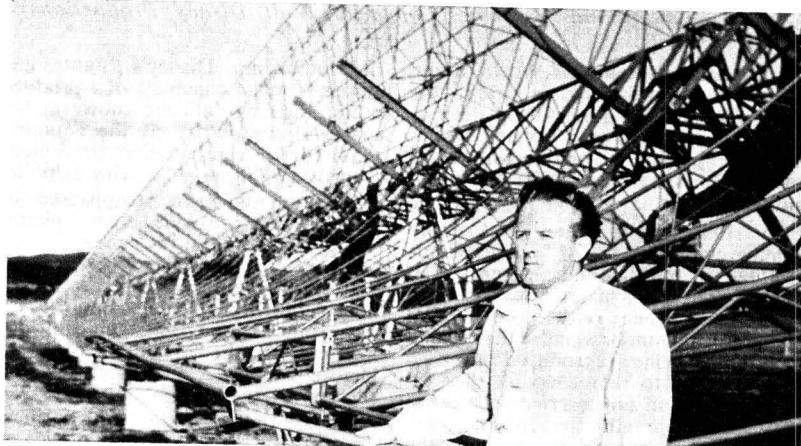
Stars die in different ways; some explode and become novae, a very few undergo a much more violent type of explosion and become super novae, and there are other possible fates. But some stars begin to shrink instead and while many physicist and astronomers have speculated on the fate of shrinking stars, none has ever been observed.

When the hydrogen fuel which sustains a star's H-bomb-like reaction becomes exhausted, then, with no explosive outward force to balance it, the inward force of gravity can cause inward collapse. Altogether, 250 stars are known which have gone nearly to the end of this process. These are the so-called white dwarfs. They are stars, originally bigger than our own Sun, which have shrunk nearly to the size of the Earth, so that their matter has become extremely dense — a matchboxful would weigh nearly a ton. But mathematical theory shows that this should not be the end of the process.

Gravitational forces are powerful enough to squeeze a dying star even closer together, so that its diameter would become a few kilometres only. To make this possible, the electrons which circle the atoms in the star would have to be squashed in, to join up with their opposite numbers, the protons in the nucleus, to form single particles, neutrons, with no electric charge, because the positive charges of the protons and the negative charges of the electrons would have cancelled each other.

No example of these "neutron stars," which are the last stages in the life of stars, has ever been found — until, perhaps, now. The Cambridge star could be small enough to be a neutron star and there are theoretical reasons why such a star might be expected to expand and contract in a regular pulsing way and to produce regular radio pulses.

If this mystery star does turn out to be a neutron star then the physicists will be pleased because their theoretical predictions will have been confirmed by observations. The next step will be to try to find what happens if a star shrinks even further. Some

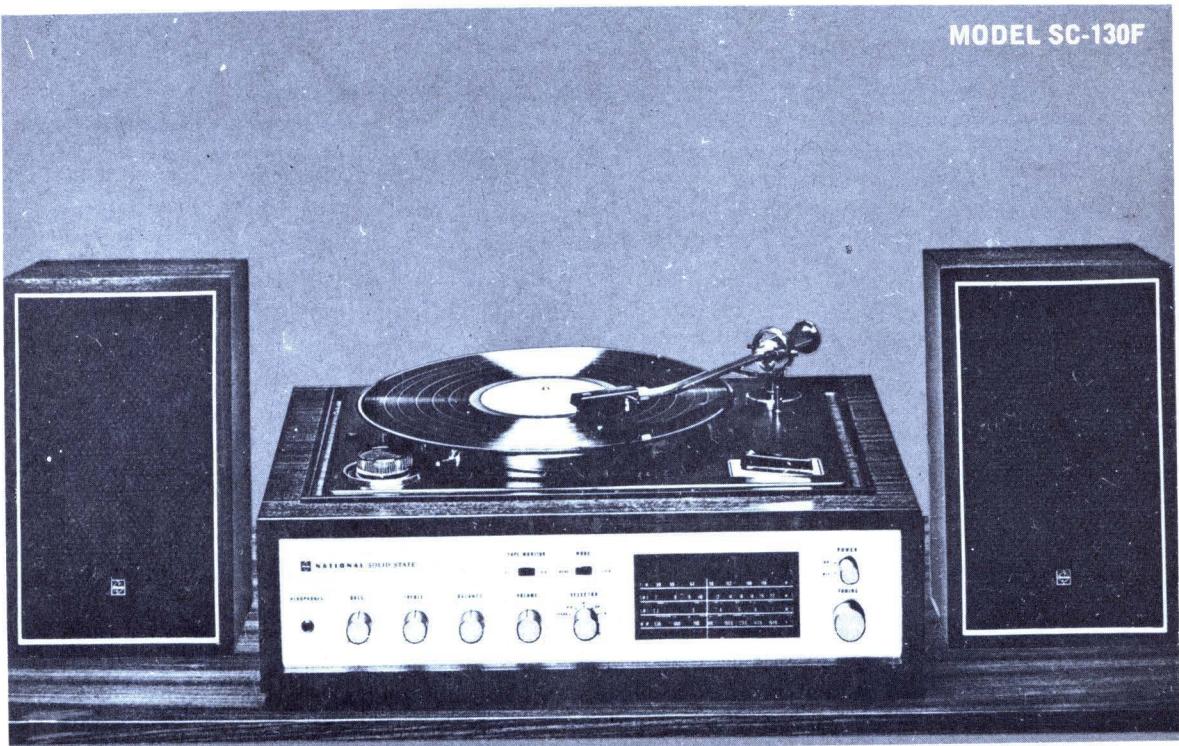


*Dr. B. Y. Mills alongside the east-west arm of his Mills Cross radio telescope at Hoskintown, near Canberra, A.C.T. This radio telescope was the first to detect "pulsars" in the Southern hemisphere.*



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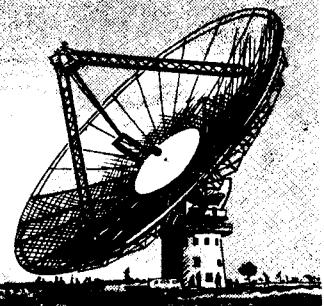
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# SCIENTIFIC AND INDUSTRIAL NEWS



## Electronic flight information

An integrated electronic control system for displaying flight information to the public has been put into operation at London's Heathrow Airport under a contract awarded to Plessey Automation. The equipment comprises an advanced arrivals indicator system for domestic and international flights. Information available to people meeting passengers includes airline livery, flight number, point of departure, previous stop, scheduled and estimated time of arrival, landed time and any remarks. In one terminal, indicator boards will inform passengers where to collect their luggage.

The arrivals indicator system is being followed by the installation of a similar Plessey system for conveying information on departing flights. This will include airline livery, flight number, destination, time of departure, gate number, comments on any particular flight, and a "hurry-up" call in the form of a flashing light.

## Domestic communications

In the first pilot scheme for a service-main system catering for radio, TV, telephone and other similar facilities, British G.P.O. engineers are preparing to lay a twin network of underground cables at Washington, Co. Durham, to connect with every house in the projected Barmston Village. Both sets of cables will be laid together in the same operation radiating from the site of a telephone exchange on the estate. One will form part of the public telephone system; the other will relay TV and radio programs from aerials at the exchange site to customers' own receivers. The TV-radio system will be rented from the G.P.O. by the development corporation to serve every tenant in the village.

## Radioisotopes in industry

Many radioisotope uses which can increase efficiency and lower costs in mining, mineral processing, metal manufacturing and other industrial operations were reported at a recent meeting of a Panel on radioisotope X-ray fluorescence applications in Vienna. The Panel was organised by the International Atomic Energy Agency (IAEA) to evaluate developments in the field and advise on the best ways to promote their adoption particularly by plants and factories in developing countries. As part of its technical assistance program, the IAEA has provided equipment for several countries, including Guatemala, India, the Philippines and Yugoslavia.

## Electronics for new earth station

Two Japanese companies dominate contracts for Australia's second commercial earth station for satellite communications. The \$4 million station, to be built near Ceduna, South Australia, for the Overseas Telecommunications Commission, will face westward working with an Intelsat III satellite over the Indian Ocean. It will handle all types of telecommunications traffic, including television relays, giving Australia direct links with Europe and Africa. Essentially, the station will be similar to Japan's earth station at Yamaguchi.

The contracts were let after world-wide tenders were called. That for the antenna sub-system (worth over \$1.3 million) went to Mitsubishi Australia Pty. Ltd., acting as prime contractor for Mitsubishi-TRW Ltd. The contract, worth about \$1 million, covering most of the radio equipment was let to Sumitomo Shoji Australia, on behalf of the Nippon Electric Co. Ltd., a member of the Sumitomo group. The multiplexing equipment will be supplied by Siemens Industries (Australia) Ltd., and the power supply equipment by F. R. Mayfield Pty. Ltd.

*The Mitsubishi-TRW antenna system has the equipment room separate from the tilting dish to provide easier maintenance. The antenna shown is identical to one to be built at Ceduna.*

## Satellite communications

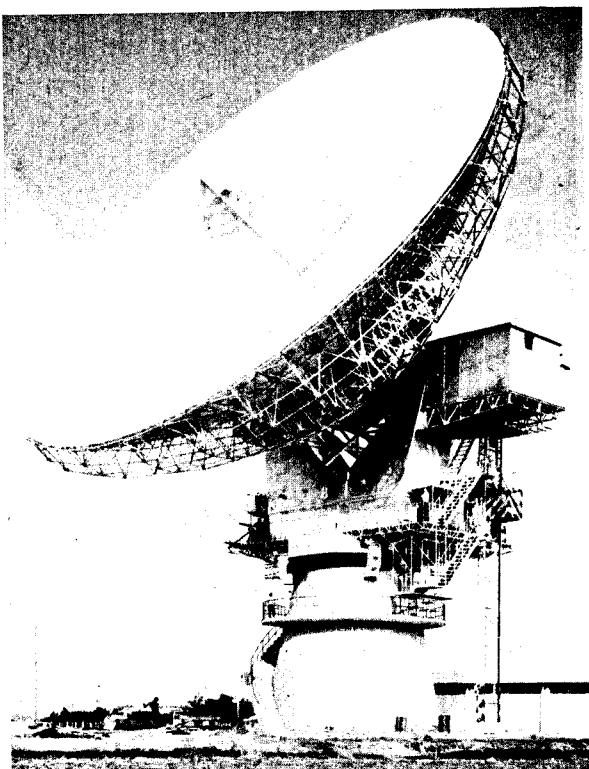
The number of international telephone circuits from the Moree earth station via the Intelsat II Pacific Ocean satellite is to be increased from 24 to 169. The Overseas Telecommunications Commission (Australia) has let contracts valued at \$906,000 for the supply and installation of terminal equipment to provide the additional channels.

Four Intelsat III global commercial communications satellites will be launched by NASA from Cape Kennedy in Florida for the Communication Satellite Corporation (COMSAT) on behalf of the International Telecommunications Satellite Consortium (INTELSAT). The first launch was set down for September 18, or as soon thereafter as feasible. Two satellites will be sited over the Atlantic Ocean, one over the Pacific Ocean and one over the Indian Ocean (working to Ceduna—see picture below). The 1200-circuit satellites of the Intelsat III series are intended to expand communication capacity and make satellite coverage available round the world.

## New building materials

Materials for building purposes and for the manufacture of some tools are being created through irradiating wood or fibre impregnated with various plastic monomers. By this process, extremely hard wood can be created from soft wood. The monomers are polymerised by the treatment and are fixed uniformly and permanently with the fibre. The complete new material thus created resists wear, decay, insects and acids, will not burn easily, lasts for a long time, retains its shape, and is easy to work with machines. It can also be given new colours.

A number of countries are carrying out research in the techniques — which may be of particular interest for building work in the Far East — following an International Atomic Energy Agency conference held in Bangkok. The substitute materials have already been used in some areas where there is a shortage of hardwood for construction.



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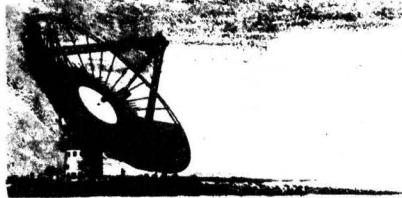
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## Ultra fast photography

The type CI-4 ultra high speed movie camera will help in the study of explosions, lasers and laser effects, etc., which sometimes call for shooting speeds of several million frames per second. The camera, built by Societe d'Optique Precision Electronique et Mechanique, Levallois, France, records a series of frames on 35mm film at a rate which can rise to as much as 3.5 million frames per second. It is equipped with a zoom lens whose focal length varies continuously from 700mm to 1200mm and whose nominal aperture is f/10.

## Marconi service

The Marconi Company has introduced a new diagnostic testing service for users of the company's data transmission system, Marconidata (H6010 series). For the new service, terminals (types H6010 and H6011) at Writtle, near Chelmsford, Essex, U.K., will be permanently open to calls from customers anywhere in the world who may wish to carry out tests on their equipment and its operation. It is anticipated that the time, effort and cost involved in locating and rectifying faults by the customer will be greatly reduced.

As an example, should operational difficulty be experienced between two centres, one operator can telephone Writtle and arrange for connection with the Marconi terminal. Once the link is established, a series of tests take place which identify the faulty terminal. Marconi engineers can then indicate the nature of the fault, its probable location within the terminal, and the method of rectification.

## Mobile colour TV unit



This colour television mobile studio (above) is designed to be used whilst on the move. Called "Unit 7", its main facilities include two colour and two monochrome channels, video tape recorder, and full production facilities (right). Space is provided for microwave link equipment to be installed later. (Thames Television Ltd., London.)

## Transportation study

The ability of mathematical models to compute accurately trends and future requirements of an overall transportation system for the U.S.A. will be evaluated by the Lockheed Aircraft International Inc., under a study contract awarded the U.S. Government. The Lockheed subsidiary, based in Los Angeles, has developed programs which can simulate every facet of a nation's transportation system. The technique enables mathematical models to ingest and correlate raw data embracing primary production and consumption centres, major commodity groups, alternative modes of transportation (road, rail, air and water) and optional routes between cities.

## Navigation beacons

A number of 100-watt marine navigation beacons for placement at strategic points on the coast of New Zealand have been ordered from Electronic Industries Ltd., of Melbourne. The beacons are a development of those currently supplied to the Australian Department of Civil Aviation for use in the vicinity of air strips. They run on batteries and have their own inbuilt charging systems. They send out a series of Morse code signals enabling shipping and aircraft to establish bearings.

## Computer-based testing

International Computers and Tabulators Ltd., Putney, London, is starting an experimental computer project in co-operation with a school at Crawley, Sussex, which will help the children in their biology studies. The project will run parallel to the school's use of programmed learning textbooks. It will remotely link interrogating visual display units to a computer installation. This adaptive testing system will be used to aid the training, guiding and scheduling of the pupils as individuals, thus improving the overall system of programmed learning.

In operation the system will test the pupils as they progress through each stage of learning. When a student is satisfied

that he has learnt a particular stage of his studies, he will use an interrogating visual display unit to test himself. The program knows what stage each student has reached and therefore selects the appropriate questions to ask. If the answers are correct, the child is told to study for the next stage. If incorrect, the program can note where the pupil went wrong and either explain where he went wrong and re-test him or tell him to see the teacher.

## Phone service for computers

The Australian Post Office is to introduce a service, called Datel, which will enable computers to communicate with each other over telephone lines. A device known as a data modem (modulator-demodulator), attached to the subscriber's existing telephone service, accepts information from computers or other data processing equipment and converts it into a signal form suitable for transmission through Post-Office facilities. Information will be presented at its destination in the form of magnetic tape, punched paper tape or punch cards, ready to be fed into the data processing equipment for which it is intended.

## Computerised traffic control

Queensland's Department of Main Roads has called for tenders for the supply, installation, and commissioning of a computerised traffic control system at Surfers Paradise. It will control 40,000 vehicles a day along one highway and will be the first of its kind in Australia. Existing and projected traffic lights will be coupled to the proposed equipment to form a complete area traffic control system.

## Flight control link

A communications link will bring Coffs Harbour (N.S.W.) flight services into direct contact with the air traffic control centres at Sydney and Brisbane. It will provide telephone and teletype communications between Coffs Harbour and Point Lookout. A tropo scatter link will connect Point Lookout and Springbrook, Queensland.



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Record players	SR-4040 2-speed belt drive. Magnetic cartridge.	SR-3030 45 & 33 1/3 rpm. Belt drive. 0.09% wow & flutter.	SR-2020 2-speed belt drive. Magnetic cartridge.
Speakers	SP-200 40W 3-way, 5-speakers.	SP-50 25W 2-way, 2-speakers.	SP-30 20W 2-way, 2-speakers.

SANSUI ELECTRIC CO., LTD. 14-1 2-chome, Izumi, Suginami-ku, Tokyo, Japan

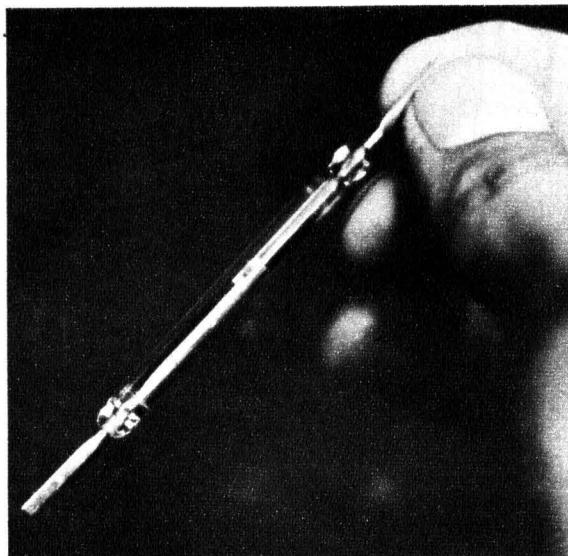


## Accident recorder

The Space and Instrumentation Group of British Aircraft Corporation has completed design and manufacture of a new accident recorder for Concorde pre-production aircraft. The unit simultaneously samples, digitises and records analogue data from 180 different sources, digital information from 120 sources and records directly five voice channels. The achieved system accuracy, including common mode and cross talk errors, is plus or minus 0.4 per cent over the temperature range of -40 to +80 degrees Centigrade. The equipment occupies one 19in x 42in rack and includes transport drive electronics and power supplies.

## All weather telephone

Plessey Telecommunications Group in the U.K. has produced a telephone for use out of doors which is claimed to work equally well in all climates. The all weather telephone is housed in a strong aluminium alloy case with a single flip-spring door displaying a telephone motif on the outside so that it is recognisable from a distance. The instrument is said to be smaller, cheaper and less liable to corrosion or damage than earlier types of outside telephones.



## British open university

Interested adults who never qualified for a place in a conventional university will be able to enrol for Britain's University of the Air in 1970. The university demands no formal academic qualifications, but standards are going to be high enough to ensure that a degree will carry as much weight as one from any other university. Tuition will be carried out largely through correspondence courses, backed up by B.B.C. TV and radio programs. Four years will be the normal minimum time for an honours degree course and, in order to qualify, the student will have to win credits in as many as eight subjects. Flexibility is to be the keynote; students will be encouraged to choose their subjects from a very wide range.

## Technical writers' society

A society of technical writers and illustrators has been formed in Sydney, tentatively, the Technical Communications Association of Australia. Branches may be formed in other cities. Membership will be offered to those engaged professionally, full-time or part-time, in the dissemination of technical information in any medium as writers, editors, illustrators and teachers. The aim of the association is to further the art of technical communication and to develop the professional competence of members. Monthly meetings are held in Sydney. Information about the association may be obtained from the honorary secretary, George Scott, Box 107, P.O. Leichhardt, 2040, or by phoning 56-3359.

## Thyristor controlled trains

Collaboration between the Swedish State Railways and the supplier, Asea, has led to the world's first assembly-line production of thyristor controlled locomotives and coaches. Standard apparatus and relays are used instead of specially designed components. The thyristor control system gives lower operating costs and smooth starting. The Swedish State Railways has ordered 60 locomotives and 90 suburban train sets with thyristor control.

## Magnetic memory drum

Sperry has introduced a new magnetic memory drum, the J.102, which features floating heads, small size ( $\frac{1}{2}$  cu ft of rack space) and a 1.5 megabit capacity. A working example of this drum, together with others in the Sperry range, was shown at the IFIP Computer Exhibition held in

A new dry reed switch, designated MR 890, for inductive loads with a rating of 100 watts, has been added to the range manufactured by the Gordos Corporation of the U.S.A. Gordos is represented in Australia by Relays Pty. Ltd., 15 Hume Street, Huntingdale, Vic. 3166.

Edinburgh, Scotland, in August this year. The J.102 is aimed at the desk-top computer, data logger and data processing markets, and offers low first cost combined with reliability. The associated Australian company, from whom further details may be obtained, is Sperry Rand Aust. Ltd., 65 Queens Road, Melbourne, 3004.

## Telex exchange

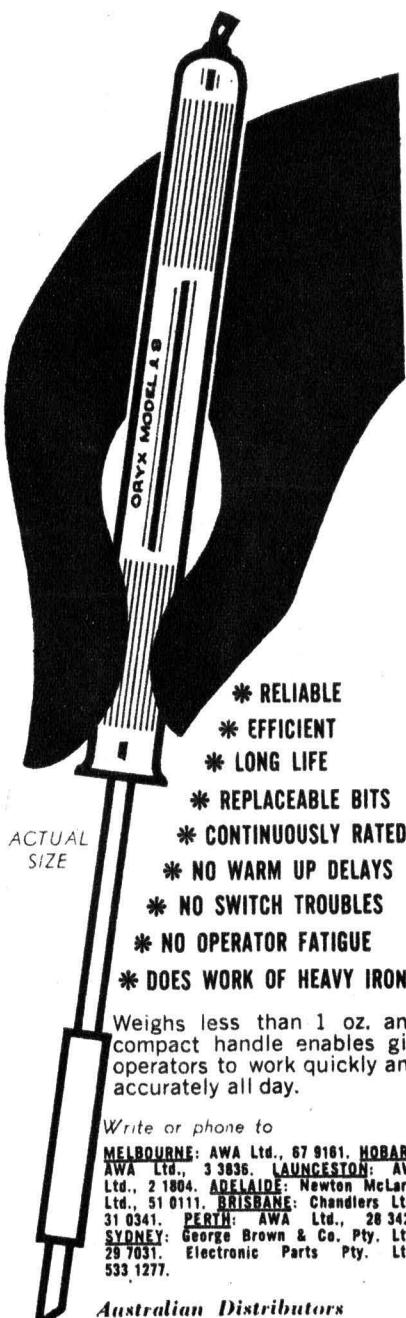
The Overseas Telecommunications Commission (Australia) has placed an order valued at about \$500,000 with L. M. Ericsson Pty. Ltd., of Melbourne, for Telex equipment for installation in the O.T.C. International Telex Exchange at Paddington in Sydney. The equipment will increase the number of international Telex circuits available from 225 to 480, and should be installed by 1970.

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# SECONDARY BATTERIES—Part Three

## The Sealed Nickel-Cadmium Battery

One form of secondary battery discussed in the previous article was the nickel-cadmium type. No discussion of secondary batteries would be complete without mention of the alternative form of nickel-cadmium battery; the so-called "dry" or sealed version now being used extensively in portable units. This description is based on text and diagrams kindly supplied by Union Carbide Australia Ltd.

The nickel-cadmium cell has been used for many years in its original form, as an unsealed cell. Postwar technological advances have made possible the extension of the nickel-cadmium system to small hermetically sealed batteries—rechargeable batteries that are free of the usual routine maintenance, such as the addition of water. These developments have brought the economic advantages of rechargeability to small batteries. Sealed nickel-cadmium cells can be recharged many times to give long useful life and are not adversely affected by long standing either charged or discharged.

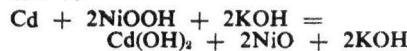
These batteries use expensive active raw materials and a complicated construction. When used within their recommended ratings, in applications where the use of rechargeable cells is justified, nickel-cadmium cells will provide satisfactory, economical, trouble-free service. New portable devices requiring more energy than is economically available from primary batteries are now practical and possible with rechargeable batteries. Sealed nickel-cadmium batteries are ideally suited for use in many types of battery-operated equipment. Some of the many applications are:

- Amplifiers
- Hearing Aids
- Electronic Photoflash
- Dictating Machines
- Electric Shavers
- Tape Recorders
- Instruments
- Alarm Systems
- Transistor Radios
- Transmitters
- Receivers
- Movie Cameras
- Emergency Lighting
- Telemetering
- Power Tools

Any secondary cell is a combination of active materials, which can be electrolytically oxidised and reduced repeatedly. The oxidation of the negative electrode occurring simultaneously with the reduction of the positive generates electric power. In a rechargeable battery both electrode reactions are reversible and the input of current in the proper direction from an outside source will drive the primary or discharge reaction backwards and in effect recharge the electrodes.

In the charged condition the positive electrode of a nickel-cadmium cell is nickel hydroxide, the negative metallic cadmium. The electrolyte is potassium hydroxide. The average operating voltage of the cell under normal discharge conditions is about 1.2 volts. The overall chemical reaction of the

nickel-cadmium system can be considered as:



The electrodes used in sealed cells of button and cylindrical configurations consist of moulded screen-enclosed active materials. In the rectangular cells the plates consist of pressed active materials held in perforated steel pockets locked into welded frames.

During the latter part of a recommended charge cycle and during overcharge, nickel-cadmium batteries generate gas. Oxygen is generated at the nickel electrode after it becomes fully

battery causes the positive (nickel) electrode to reach full charge first and it starts oxygen generation. Since the negative (cadmium) electrode has not yet reached full charge it cannot cause hydrogen to be generated.

3. The cell is designed so that the oxygen formed can reach the surface of the metallic cadmium electrode where it reacts, forming electrochemical equivalents of cadmium oxide.
4. Thus in overcharge the cadmium electrode is oxidised at a rate just sufficient to offset input energy,



Three basic configurations in which the nickel-cadmium cell is commonly produced; button, cylindrical, and rectangular. Applications range from miniature hearing aids to emergency lighting plants.

charged and hydrogen is formed at the cadmium electrode when it reaches full charge.

A conventional vented type nickel-cadmium battery will liberate oxygen and hydrogen plus entrained electrolyte fumes through a valve. In order to hermetically seal a nickel-cadmium cell it is necessary to develop means of using up this gas inside the cell. This is accomplished as follows:

1. The battery is constructed with excess ampere-hour capacity in the cadmium electrode.
2. Starting with both electrodes in the fully discharged state, charging the

keeping the cell in equilibrium at full charge.

This process can continue for long periods. The level of oxygen pressure thus established in the cell is determined by the charge rate used.

"Eveready" nickel-cadmium cells using these construction techniques are available in three basic configurations—button, cylindrical and rectangular. The range of capacities for each type is as follows:

Button: 20-3000 Milliampere-hours.  
Cylindrical: 450-4000 Milliampere hours.  
Rectangular: 1.5-23 Ampere-hours.

Sealed nickel-cadmium cells have a relatively constant discharge voltage. They can be recharged many times for long lasting economical power. They are small convenient packages of high energy output. These cells never require the addition of water or electrolyte. They are hermetically sealed in steel cases, there is no gassing and they require no maintenance. They have a long active life and an indefinite storage life. Long idle periods in either the charged or uncharged state do not adversely affect them. They are leak-proof and will operate in any position. They have a very low internal impedance. They are rugged and have a high resistance to shock and vibration. These cells have a wide range of operating temperature. At high temperature, however, charging or discharging at higher than recommended rates or repeated complete discharge of the cells to cutoffs lower than those recommended, adversely affects the cells by accelerating disintegration of the electrodes.

Excluding the smaller button types, these cells may be used individually or in series stacks. The exceptions are types not protected against polarity reversal and should be used only as a single cell. The reason for this is explained later.

Button cells may be used in a clip or holder, or may be soldered into the circuit by means of small solder tabs welded on the top and bottom of the cell. One should never attempt to solder directly to the cell case as the seal may be damaged by heat. Since the nickel-cadmium cell is a long-life device it can be considered as much an integral component as any other installed part and wired directly into the circuit. When required, two to 10 button cells may be assembled into a high voltage series stack by special factory welding techniques. The assembly is usually jacketed to improve rigidity and provide stack insulation. It is not recommended that unit button cells be stacked in a pressure held assembly because of possible contact resistance changes in long term use. Cells should be assembled in the factory on a welded cell-to-cell basis.

Cylindrical cells are available in a wide range of sizes, including equivalents for the popular "AA" (penlite), "C" and "D" size primary cells. They are normally available with or without solder lugs welded to the normal contact terminals. There is also a type having the same diameter as the "AA" cell, but it is approximately twice as long and of greater capacity.

Rectangular (prismatic) types cover a range of capacity of 1.5-23 ampere-hours. The case of a rectangular cell is welded steel. It contains a safety vent which is actuated only in the case of severe misuse of the cell. Connections are made to a nut and stud negative and welded tab positive in the smaller size and a nut and stud for both positive and negative in the larger sizes. The steel case is polarised positive for all rectangular cells.

Sealed nickel-cadmium cells should not be connected in parallel. Minor differences in internal resistance of the cells may result, after cycling, in extreme variations in their states of charge, leading to overcharge at excessive currents in some cells and polarity reversal in others.

It is difficult to determine accurately the condition of a nickel-cadmium battery. The only way to be certain is to put it through several discharge and charge cycles. If the voltage of a cell is low—for example, less than 1.0 volt—it may merely mean that the cell needs to be charged. If the open circuit voltage of a cell exceeds 1.40 volts it can generally be assumed that the cell is fully charged. In between these values the state of charge cannot be determined accurately; there is no quick test which will indicate the ampere-hour capacity remaining.

During discharge, the average voltage of a sealed nickel-cadmium battery is approximately 1.2 volts per cell. At normal discharge rates the characteristic is very nearly flat until the cell approaches complete discharge. The battery provides most of its energy above 1.1 volts per cell. If the cell is discharged with currents exceeding the rated value, however, the voltage characteristic will have more of a slope, a lower end point voltage will be necessary and the ampere-hour capacity per cycle will be reduced.

When cells are connected in series and then discharged completely, small differences in the ampere-hour capacity of the individual cells will cause one cell to reach complete discharge sooner than the remainder. The voltage of these other cells will cause current to continue to flow through the completely discharged cell. This will cause the

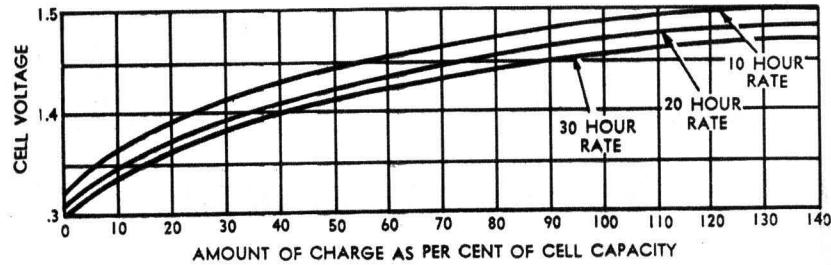
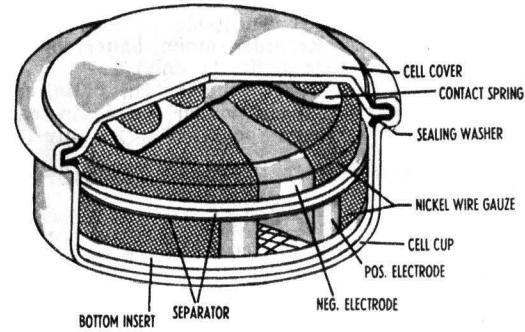
cell to over-discharge and reversal of electrode polarity will occur.

When this happens, in an ordinary sealed nickel-cadmium cell, oxygen will be evolved at the cadmium electrode and hydrogen will be generated at the nickel electrode. If there is no way of reacting these gases, pressure will build up until the cell ruptures. This condition is prevented in "Eveready" sealed nickel-cadmium cells by special construction features. These include the use of additional active materials, called "anti-polar mass," in the nickel electrode. It is then possible to prevent hydrogen formation and to react the oxygen formed during deep discharge by the same basic process used to prevent gassing on overcharge.

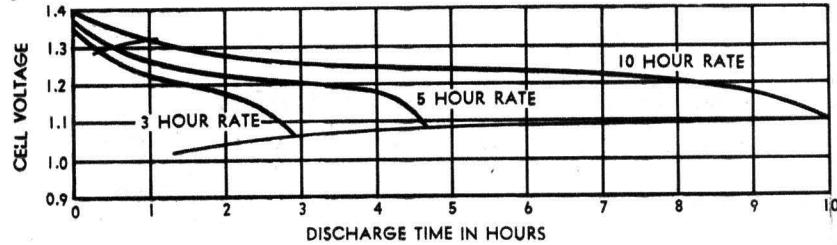
A cell is considered protected against reversal of polarity if, after discharge at the 10-hour rate down to 1.1 volts, it may receive an additional five-hour discharge with the same current without being damaged or otherwise affected. This protection applies to all "Eveready" nickel-cadmium cells except types B20 and B50 which, as previously noted, should not be stacked. Types C450T and C450 do not quite meet the above definition of reversal protection, but still can be series connected. The maximum current for which sealed nickel-cadmium cells are protected against polarity reversal is the 10-hour rate discharge.

Typical self-discharge curves for nickel-cadmium cells are shown

Cutaway diagram showing construction of the button type nickel-cadmium cell. Sizes range from 20 to 3000 mAh.



The charging characteristics of a typical button cell are shown in this graph in which cell voltage is plotted against percentage of charge.



Discharge characteristics of the same cell. Note that the full ampere-hour capacity will only be achieved at the 10-hour (or longer) rate. The shorter rates are less efficient, but do not harm the cell.

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on page 41. The characteristic is shown as a decline in per cent of rated capacity available. Note that after the first month the capacity decreases only gradually with age. These rechargeable batteries have lower self-discharge rates than any other present secondary battery system. More important, the batteries are not harmed even if not used for long periods of time.

Sealed nickel-cadmium cells experience a relatively small loss of capacity at operating temperatures ranging from  $-20^{\circ}\text{C}$ . to  $+45^{\circ}\text{C}$ . Within this range the characteristic stable discharge voltage is maintained. Ranges of temperature applicable to operation of the cells are:

Charge:  $0^{\circ}\text{C}$ . to  $+45^{\circ}\text{C}$ . ( $32^{\circ}\text{F}$ . to  $113^{\circ}\text{F}$ .)

Discharge:  $-20^{\circ}\text{C}$  to  $+45^{\circ}\text{C}$ . ( $-4^{\circ}\text{F}$ . to  $113^{\circ}\text{F}$ .)

Storage:  $-40^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$ . ( $-40^{\circ}\text{F}$ . to  $+140^{\circ}\text{F}$ .)

The batteries may be discharged at a maximum temperature of  $71^{\circ}\text{C}$  ( $160^{\circ}\text{F}$ ). This does not apply to charging or storage as high temperatures in both instances are detrimental.

At storage temperatures of  $100^{\circ}\text{F}$ . to  $120^{\circ}\text{F}$ . self-discharge will increase considerably as compared to  $70^{\circ}\text{F}$ . This is a result of the chemical reduction of the nickel electrode. Prolonged storage at high temperatures can result in cells being irreparably damaged. Storage temperatures can have a marked effect on expected life; for best results it is recommended that batteries be stored at  $70^{\circ}\text{F}$ . or lower. Cold storage offers a definite advantage. If cells have been stored for a long period, regardless of the temperature of storage, they should not immediately be charged, but should first be fully discharged and then charged with a current not exceeding the 20-hour rate. Discharging the cells first breaks down oxide that forms on the cadmium electrode. This is necessary since during the operation of the cell oxygen must react with metallic cadmium.

Sealed nickel-cadmium cells have a high effective capacitance. Their impedance is so low that cells, which in effect are being continuously overcharged, can be used to replace very large capacitors for filtering the ripple out of DC power supplies. In the filter application, of course, current flow through the cells must be kept in the normal extended overcharge range thus limiting voltage across the cell to 1.45 - 1.50 volts. Cell impedance is dependent upon frequency and state of charge of the cell. It is lower for a charged cell than it is for a discharged cell.

Under conditions of very light or casual service, the expected life of the cell is several years. Neither cycle life nor eventual cause of failure can be given because of the obvious difficulties in obtaining such information.

On a conservative basis, cycle life for the various types should exceed the following figures. Button: standard type and high rate moulded electrode types, 200-250. Cylindrical: standard moulded electrode and pocket plate types, 100. High rate types, 300. Rectangular: standard pocket plate type, 300. High rate sintered plate type, 300.

Cycle life is based on an endpoint of 80 per cent of the rated ampere-hour capacity, with a discharge and charge current equivalent

to the 10-hour rate and with discharge carried to the normal 10-hour end voltage on every cycle. If the discharge current is increased from the 10-hour rate, the cycle life is reduced. On the other hand, if discharge current is reduced or if discharges are terminated before complete capacity removal, cycle life can be expected to improve.

Charging equipment for sealed nickel-cadmium cells is simple and can be incorporated as an integral part of the end use device. Half-wave or full-wave rectification is satisfactory and no filtering is required. Half-wave rectifiers are generally used for low current applications, and full-wave rectifiers for the higher charging currents associated with high capacity batteries.

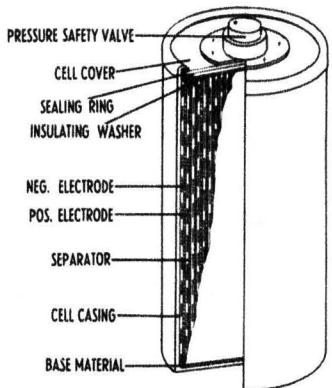
As with other types of secondary batteries the basic requirement for a charger is a source of direct current having a voltage higher than that of the fully charged battery. The positive terminal of the charging source is connected to the positive terminal of the battery so that the charging current flows through the battery in the direction opposite to that of the discharge current.

Constant current charging is recommended as not only the cheapest and simplest method, but also one which will prevent the possibility of "thermal runaway." It is obtained by making the supply voltage much greater than the battery voltage and limiting the current flow with a large amount of series resistance. The 10-hour charge rate should not be exceeded in constant current charging. Fourteen hours charging at this rate will fully charge the cell.

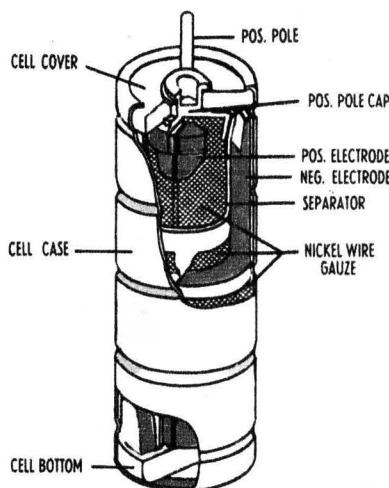
The battery can also be trickle charged or floated. A trickle charge is a continuous constant current charge given to a battery to maintain it in a fully charged condition, with no external load connected to it. This may be used for batteries in storage, or in standby service where their only use is in an emergency such as failure of the normal power supply.

For maximum performance in situ-

the battery is continually connected to an electrical system including a charger and a load. The charger may be designed to maintain a constant voltage throughout its load range or a constant current charger (actually a power sup-



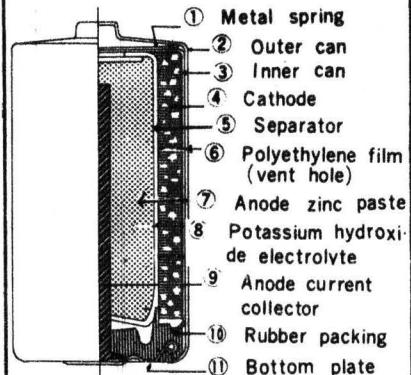
*Two forms of construction for cylindrical cells. Above: The pocket plate type, used for standard rate cells. Below: The sintered plate construction used for high rate types.*



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**MAXELL Alkaline Dry Cell** — this unique new design concept features high capacity and durability that surpasses the performance of the world's top dry cell batteries. The construction of the Maxell Alkaline Dry Cell differs greatly from conventional types of carbon ZINC cells. However, the Maxell Alkaline cells can be used where you normally use a carbon ZINC cell. MAXELL ALKALINE CELLS are especially suitable where there is a demand for increased current, combined with durability and little voltage drop. Even near the end of the cell life the discharge capacity is large and stabilized.



Exclusive new construction minimises leakage. Double cans are used and rubber sealing with the unique spring safety device. (see diagram)

Interior drying is prevented by hermetic sealing, therefore long storage periods are possible (over two years). Even then Maxell Alkaline cells are in the same condition as when they left the production line. These cells will withstand severe temperature changes. Rigid tests have shown extremely stabilized capacities from the low temperature of -4F to the high temperature of 150F at which temperatures dry cells would fail to operate satisfactorily.

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C450T & C450 C900	70 millionohms 62 millionohms	65 millionohms 60 millionohms	52 millionohms 53 millionohms	46 millionohms 50 millionohms

*Table showing values of impedance for cylindrical cells when used in place of filter capacitors.*

ations of continuous overcharge with occasional interruptions the current should not exceed the 30-hour rate. The trickle charging current required to keep the battery constantly in a fully charged condition should not exceed the 50-hour rate.

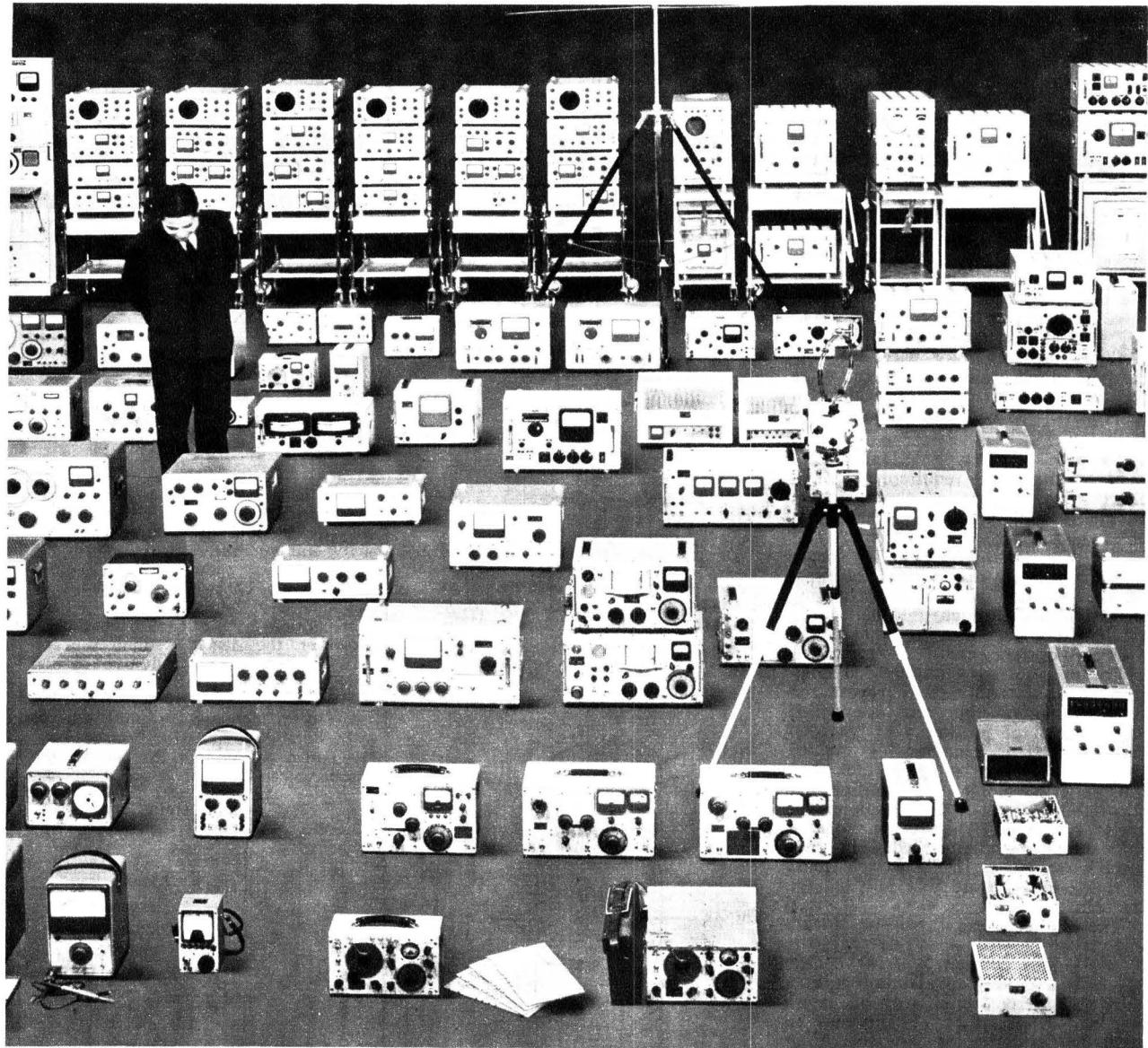
To compensate for self-discharge of a fully charged cell a trickle charge current at the 300-hour rate is required to keep the cell in near fully charged condition. The cell voltage with this charging current establishes itself at 1.38 volts. For optimum performance on trickle charge discharge the cell every six months to 0.9 volt and recharge at the 10- to 20-hour rate. This reforms the electrodes.

Float charging is a system where

ply) can be used where load variation is not great.

In the case of the constant voltage charger, the value of this voltage is such that it supplies to the battery sufficient current to overcome its internal losses and keep it fully charged, but without appreciable overcharge. Following any discharge, the battery will automatically draw a higher current which will decrease as full charge approaches, until it is again reduced to the low maintenance value.

The floating current should be adjusted to replace 1.3 times the capacity withdrawn from a cell. For example, if about 1/10 of the cell capacity is withdrawn from a fully charged cell in a 24-hour period, the terminal voltage



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while the cell is on charge should be maintained at 1.40 volts. If the full capacity of the cell is withdrawn in a 24-hour period (to a 1.1 volt end point), this voltage should be set at 1.42 volts.

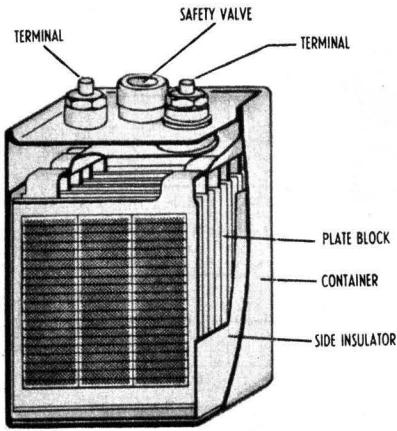
Constant voltage charging is not recommended for the following reasons:

1. Small variations in the supply voltage cause large variations in the charge rate.

2. The circuitry is expensive.

3. Constant voltage overcharging of sealed nickel-cadmium cells may lead to conditions of thermal runaway.

The action leading to thermal runaway is as follows. As the cell charges, its voltage increases and the charging current, which is set by the difference between the constant charging voltage and the battery voltage, constantly decreases. At full charge, however, the overcharge current begins to produce heat. This causes an increase in temperature, which decreases the cell "on charge" voltage, increasing the current still further. If this action is allowed to continue it will result in excessive temperatures and currents.



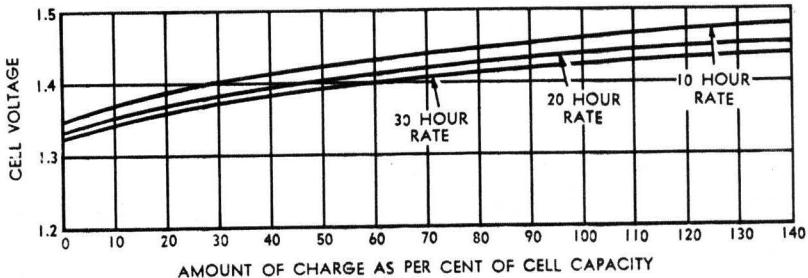
Cutaway diagram showing construction of rectangular cell. Capacities range from 1.2 to 23 ampere-hours.

Thermal runaway need not happen; any method of reducing the charging voltage or ensuring good temperature control may be employed to protect against runaway. Thermal runaway does not occur during charging but may occur during overcharging.

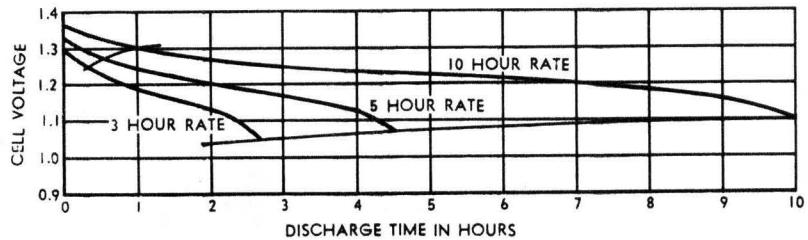
These cells will also stand extended overcharge at rates considerably higher than those recommended for floating. Although charging at the maximum rate (10-hour) is normally expected to be finished in 14 hours, cells will not be damaged by occasional charging at this rate, even for several weeks. Continuous overcharging at higher than necessary rates accelerates general degradation of the cell, but complete or sudden destruction will not result unless the 10-hour rate is exceeded.

Cells must not be charged at rates exceeding the 10 hours or oxygen may be evolved at the nickel electrode faster than it can be reacted at the cadmium electrode, with the result that sufficient pressure will build up to cause cell rupture.

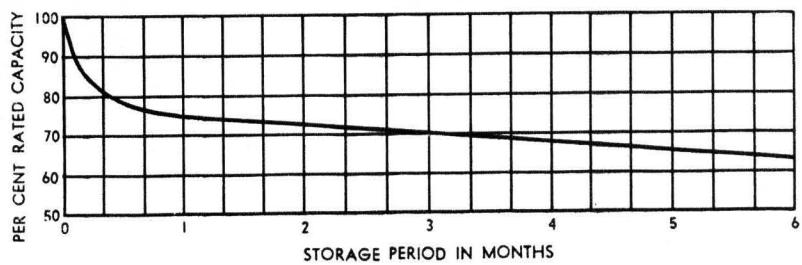
Extended overcharging at high temperatures is very detrimental to the cell.



Charge characteristics for a typical cylindrical type cell. Nickel cadmium cells need to be charged for 14 hours at the 10-hour rate to achieve full charge.



Discharge characteristics for the same cell. Data of this kind can be most useful in helping to select the most appropriate size cell for a particular application.



Graph showing internal losses of a cell plotted against storage time. Rate of loss is high in the first few weeks but drops thereafter.

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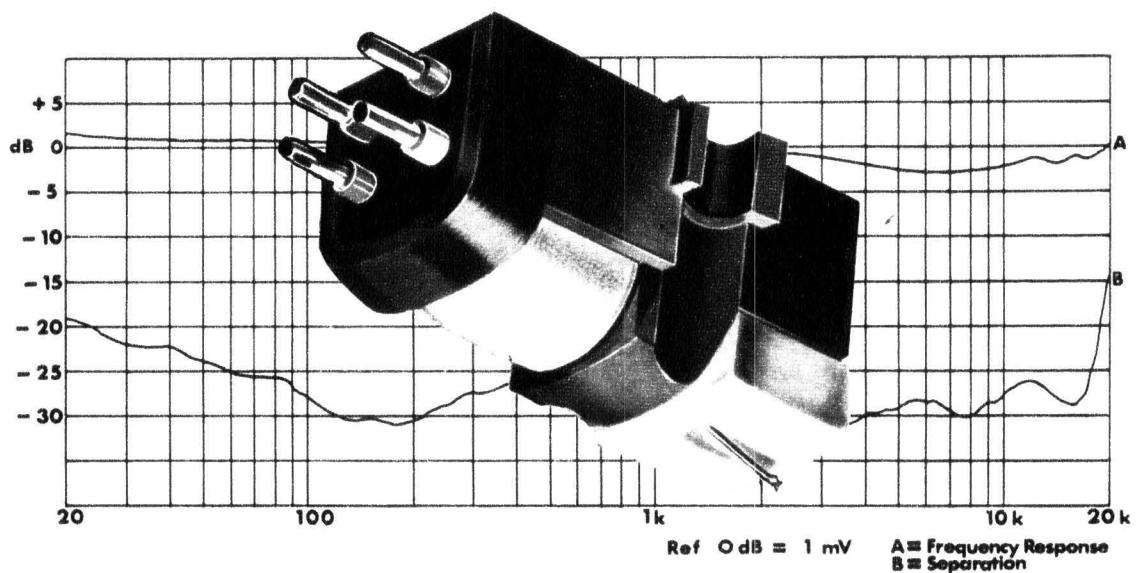
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Specifications:	'800'	'800E'
Type	Magnetic	stereo & mono
Frequency Response	20Hz-20kHz	10Hz-25kHz
Sensitivity	5.5mV at 5 cm/sec	
Separation	25dB at 1kHz and nowhere less than 15 dB	
Load	100k-47k/ohms	
Compliance	$20 \times 10^{-6}$	$30 \times 10^{-6}$
Static	cm/dyne	cm/dyne
Effective Point		
Mass	1 mg	less than 1 mg
Stylus Point	Conical 0.0005"	Elliptical .0008" x 0.0003"
Tracking Weight	1-3 gm	0.75-2 gm
Head Weight		8 gm
Connections		4 pins
Fixing	Standard 1/2" centres	
Vertical Tracking Angle		15°
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Removable Stylus		

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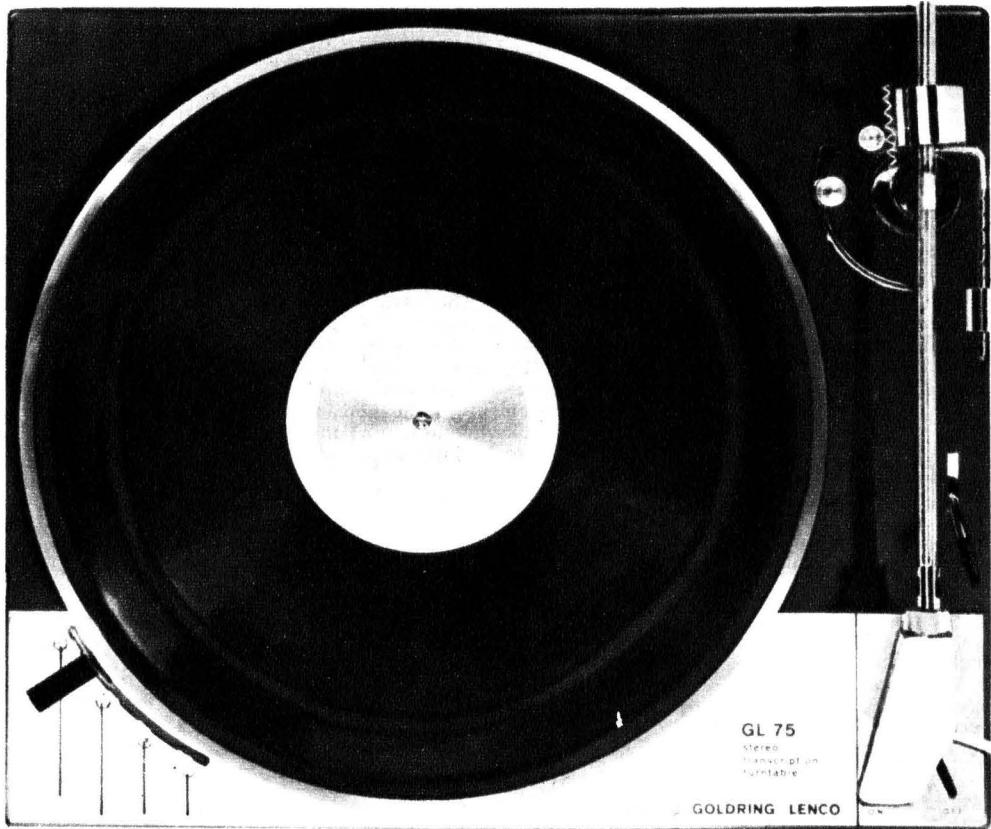
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# L.S.I. or LARGE-SCALE INTEGRATION\*

While the electronics industry is still seeking to cope with—and adapt to—integrated circuits, a new term is appearing in technical literature: it is Large-Scale Integration or L.S.I. What does it mean and how does it relate to ordinary integrated circuit concepts?

by Ron Brown

Three vital words in the electronics world today are "large-scale integration": they are arousing the same sort of reactions as the word transistor, laser and integrated circuits aroused when they first became widely known.

It is rather difficult to define just what large-scale integration (LSI) is, principally because it is not something completely new, but is rather an extension of present integrated-circuit techniques. It was the subject of a colloquium held in London earlier this year by the Institutions of Electrical Engineers (IEE) and Electronic and Radio Engineers (IERE).

The general definition of an integrated circuit is simple: "one that is made as a single entity, and cannot be taken apart and reassembled." Integrated circuitry is a stage along the road toward very small size and simplified manufacturing techniques.

At the next stage, large-scale integration, the rewards will be very great. Indeed, they may well be as great as those brought about by all the previous developments in electronics in this century (see figure 1). The value of LSI lies primarily in compacting, which requires very large repetitive arrays of circuits with elementary logical functions. But what is made possible in one field often finds rapid application in others.

As its name implies, LSI is integrated electronics on the large scale—whole arrays of hundreds and eventually perhaps thousands of fully interconnected integrated circuits of the type now available individually.

Committees of all shapes and sizes have tried to find a clear dividing line between ordinary integrated circuits and large-scale integration, but with little success. One suggestion that has had perhaps the widest acceptance is that an integrated circuit array becomes a large-scale one when there are more than 100 interconnected, individual integrated circuits in it. But already one leading manufacturer in this field, Fairchild Semiconductors, has introduced what it calls an LSI array that contains only 32 circuits.

It has long been possible to manufacture large numbers of interconnected integrated circuits on a single slice

of silicon. The difficulty until recently has been that a high percentage of the individual circuits in the arrays were always faulty. This meant that most of the arrays had to be thrown away, which pushed the cost of the good arrays way above the economic limit. It is the improvement in the percentage of good circuits manufactured that has made large scale integration possible.

The more circuits there are on each slice of silicon, the cheaper is each circuit; but against this must be set the fact that, the more complex each individual slice is, the greater the loss if it has to be thrown away at the end of the production line because of a single faulty circuit.

It is not difficult to show that, for any given percentage manufacturing

yield of good circuits, there is an optimum number of circuits per silicon slice that will give the minimum cost per circuit.

Helmut Wolf and a co-worker from Signetics Corporation told the Munich International Symposium on Microelectronics some time ago that, in 1962, 10 components per slice was the optimum figure. This number increased to 70 by 1966, when the cost per component had been reduced to 1/30 of the cost in 1962. They predicted that the optimum number would be 1,000 in 1970 and about 5,000 in 1972.

The ability to build large arrays of

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Figure 2: The "master slice" technique is a way of using a single standard array of circuits for many purposes, by varying the way in which the circuits are linked together.

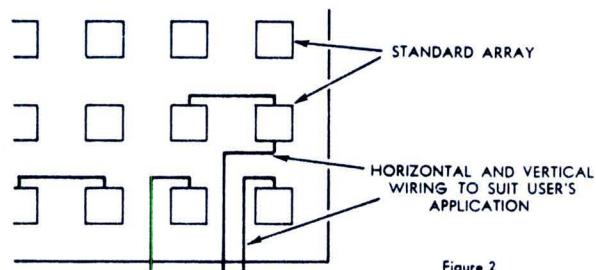


Figure 2

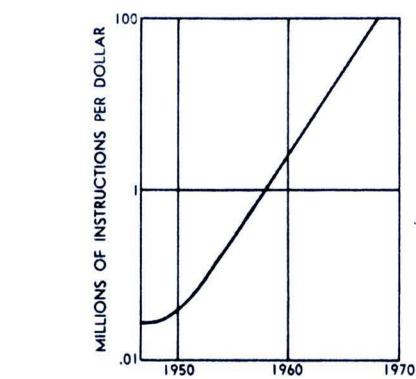
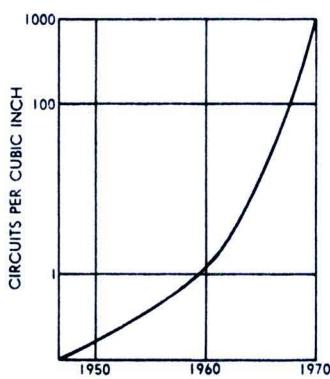


Figure 1: As the number of circuits per silicon chip increases towards a figure of 1000 in 1970 (curve at left) so the sizes of computers and the cost of carrying out a given task will fall dramatically, as per the curve at right. (After William A. Notz and co-workers of IBM New York).

circuits does, paradoxically, bring its own economic problems. Each individual circuit may cost very little; but the cost of a complete array of such circuits is very high indeed. Apart from the problem of having to throw away an expensive array because one of the individual circuits is faulty, the manufacturer is faced with the problem of finding a large enough market for each design of array to justify making it. The more complex the array, the more difficult this is. Computer manufacturers want a number of arrays of different types.

This difficulty has led to a search for means of producing large arrays cheaply in small quantities, and considerable success has been achieved using "variable interconnection patterns."

This idea may be illustrated by the "master slice" technique (Figure 2). Here the mass production line churns out large numbers of identical arrays of integrated circuits; but the final step of interconnecting them is omitted. The small quantities required for each specific application are produced by printing particular interconnection circuits on the general purpose array.

This method greatly reduces the cost of providing arrays in small quantities; but the facility of making the interconnections at a later stage is bought at the cost of greatly increasing the area taken up by each array (to leave room for a variety of possibilities). One estimate, by IBM, shows that 23,000 circuits can be made up in an area of one square inch if the interconnection pattern is fixed, while only 7,700 circuits can be accommodated using the master slice system.

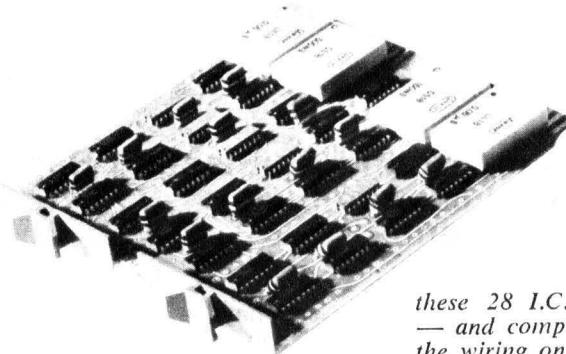
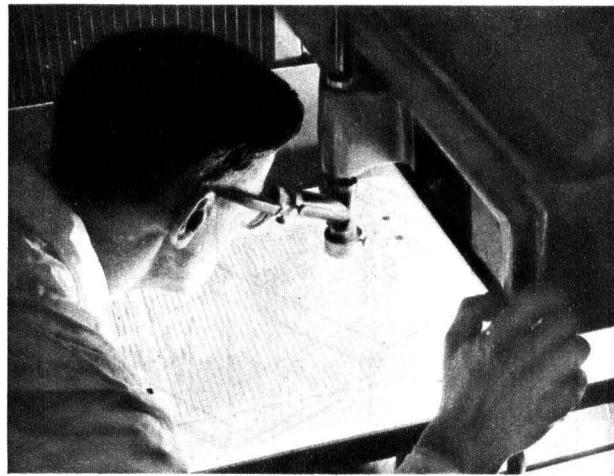
Another approach, called discretionary wiring, is similar to the master slice method, up to a point — large numbers of similar integrated circuit arrays come off the production line, with their constituent circuits unconnected. The difference is that all the circuits in each array are tested automatically, by a probe controlled by a computer. The computer then calculates a pattern of interconnections, for the particular array, that will bypass any faulty circuits and still meet the customer's functional requirements.

Now, a technique like this, in which a complex design stage must be completed within the production process, clearly requires unusual design methods.

In one version, investigated by Texas Instruments, the "mask" which is used in printing the interconnections is made by photographing a pattern displayed on a cathode ray tube controlled by the computer (Figure 3). C. P. Sandbanks of Standard Telecommunications Laboratories described a different version at an Institution of Electrical Engineers Conference last year, which actually cuts out the mask-making stage. His idea is for the computer to control a machining tool, which etches the desired interconnection pattern with a laser.

The need to design and manufacture circuitry in such a way that the faulty circuits in an array cause no trouble, is only one peculiarity of LSI as regards design. Another is that, if the full benefits of rapid, simplified production methods are to be gained, design will have to be speeded up

An inspector checks the interconnections for what will be part of a 12-layer board for the central processor of an I.C.T. 1906A computer. The connections were planned in the first instance by another computer and then drawn by an automatic drafting machine coupled to it.



This four-layer board accommodating 28 normal integrated circuits, plus interconnecting wiring, is from the central processor of an I.C.T. 1900 series computer. L.S.I. would take these 28 I.C.'s — perhaps more — and compress them along with the wiring on to a single slab less than an inch across.

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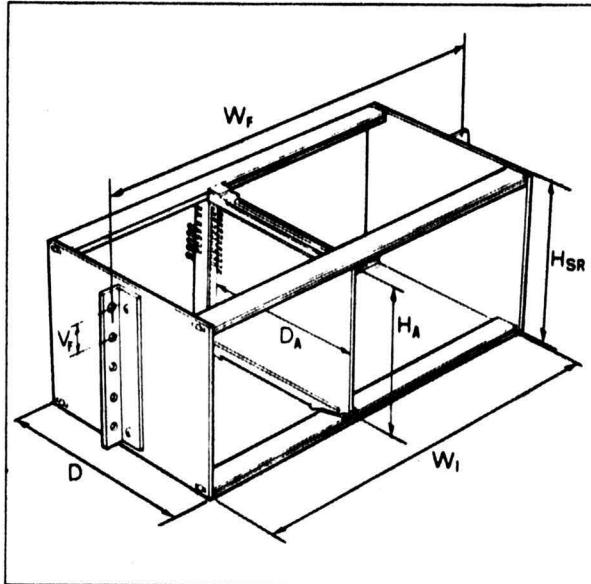
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correspondingly. Thus, there is a move towards using computers also to help in the original design work.

For the moment, perhaps the ultimate in computer-assisted design for large-scale integration is Motorola's "Polycell" approach. For any particular customer requirement, the designer can call up from the computer's memory any combination of elements he requires. With a light pen he can make progressive changes to his design, displayed on a cathode ray tube. The computer checks the final design and then translates it into instruction for an automatic draughting machine, which prepares a complete set of mask masters for producing the desired array. W. Raisanen of Motorola is reported in the journal "Electronics" as saying that prototype arrays to customers' specifications can be produced within two weeks to a month, at a cost of not more than a few thousand dollars.

An important advantage that accrues from bringing in a computer to help

A somewhat similar idea has been proposed by two Plessey engineers.

Manufacturers in many countries are re-organising their design and production units ready for the great expansion in LSI. At the combined Marconi and Elliot stand at the Components Exhibition in Paris, for example, MOS (metal-oxide semiconductor) devices were on show with 300 transistors on a single chip. Ellitols were recently awarded a contract worth £40,000 by the Ministry of Technology to cover 50 per cent of the cost of a microcircuit development program. This is the first contract the Ministry have placed under their Microelectronics Production Technology program, intended to provide massive support for the British industry—support that should help the British industry to hold its own against American competition.

The user of computers will benefit from LSI in a number of ways. The reduction in cost will make economical the use of many of the more complex

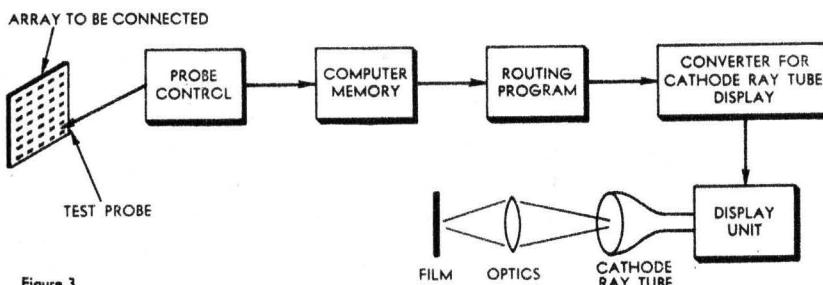


Figure 3

*Figure 3: The Texas Instruments "discretionary wiring" system. A probe checks for faulty circuits in each array. A computer then produces an interconnection pattern which avoids the faulty circuits, and displays it for photographing.*

the designer in this way is that it can simulate, using its own circuitry, the designed circuit array, and test the simulation under a variety of conditions before any expensive physical processes are started.

Returning to the question of how to obtain the benefits of mass-production while making only a limited number of arrays for any one purpose, a fundamentally different approach was described recently by Sven E. Wahlstrom, of Stanford Research Institute, Menlo Park, California.

His idea is to produce huge quantities of highly interconnected (rather than unconnected) identical arrays, in which the interconnections that actually function are determined by signals transmitted along additional, control interconnections. Hundreds of different functions could in this way be performed by identical arrays, which because they could be made in huge quantities would have very low cost.

To perform a given function, several times the amount of circuitry strictly necessary would have to be made, but this extra cost would be more than offset by the saving inherent in the technique. Any given array could be made to perform different functions at different times simply by changing the control signals; this could lead to a dramatic improvement in the flexibility of computers.

types of computer circuits. There may not be a dramatic reduction in the total system cost of computers of a given size. This is because today's circuit costs are only a small fraction of the total price, so that even a very large reduction in circuit price would not appreciably affect the total price.

But, on the other hand, much larger computers can be made for the same price. The very high circuit density possible with LSI means that the time-delays inevitable in the cabled interconnections of present day computers will be greatly reduced. Reducing the amount of wiring needed for interconnections will also greatly improve the reliability of computers.

A rather fundamental point is that reducing the cost and increasing the density of the logic will enable designers to produce computer hardware capable of carrying out many of the functions that at present need software. (In general, a logical process can be done either by a circuit designed specifically for the purpose, or by a more general-purpose circuit acting according to a set of instructions. Which type of solution is chosen depends on the relative costs of hardware and software.)

This shift towards inexpensive special-purpose hardware will ultimately make possible small remote terminals, in private homes, which will use programming languages simple enough for large sections of the population.

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# Forum

## Packaging, labelling and high fidelity

This is one of those months when debate is not running hot on any one subject but there is, rather, a clipful of items on quite unrelated themes. So let's take them as they come, and give readers a chance to comment.

### Conducted by the Editor

First item in the clip is a copy of a par, from the July, 1968 issue of "High Fidelity" magazine. While it records an idea held thousands of miles away, it may well raise a cheer from those correspondents to E.A., who feel themselves taken when they buy a prerecorded tape which occupies only a fraction of the space on a 7-inch reel. Nor should I forget our jazz reviewer, Forbes Cameron, whose pet hate is a 12-inch record which plays for a mere 10 or 12 minutes per side.

**PACKAGING, LABELLING:** "When Congress passed the Fair Packaging and Labelling Act last year, nobody thought it would affect the hi-fi buyer. Aimed primarily against alleged abuses in the packaging of detergents, cereals, and instant coffee, the law seemed designed mainly to help the housewife in the supermarket.

"Now it appears that the hi-fi buyer may reap some benefits too. The Federal Trade Commission, which is charged with enforcing the new regulations, plans to investigate a number of non-food items (such as raw and prerecorded tape, record and tape cleaners and cleaner kits, and possibly long-playing records) to see whether they are "consumer commodities" within the meaning of the law.

"If the F.T.C. decides they are, we may witness some important audio side-effects. For example, the law requires every package to contain a declaration of the street address, city, State, and zip code, as well as the name of the manufacturer or distribu-

tor. In effect, therefore, it would require "white box" (scrap or reject) recording tape to carry an identification of the manufacturer or distributor — someone the customer could complain to if he were dissatisfied. Until now, manufacturers have avoided identifying their white box merchandise because they know it's bad enough to cause customer complaints.

"The F.T.C. also could have something to say about those seven-inch packages of prerecorded tape which, when opened, reveal only 150 to 200 feet of tape. The law requires that a package may be only big enough to hold the contents — not so much larger as to lead the consumer into assuming he's getting a lot more for his money. Although the record industry is expected to object, the F.T.C. may even question, on the same grounds, the use of twelve-inch LPs to hold less than thirty minutes' worth of music.

"So far, tape and record manufacturers have argued that these products are not "consumed" during normal use within the meaning of the law. Unless the F.T.C. agrees, it intends to start enforcing the new label orders on January 1, 1969.

While this impending controversy is centred thousands of miles from these shores, the effect of any marketing change in the U.S.A. would inevitably be felt here without too much delay. A lot of record - stampers come into

this country for local pressing and, if manufacturers for the American market were forced to revert to 10-inch pressings or to increase the playing time of 12-inch records, that's the way they would appear on the Australian market. It would be cheaper to follow suit, in most cases, rather than remaster here, deleting unwanted items from the tapes, modifying copyright obligations and rearranging jacket notes.

And, continuing the old "what's good for the goose" theme, one would expect that tape cassettes and cartridges would be similarly affected. It could put a spike in the Philips system (Norelco in America) where you can have 60 plus 60 minutes of blank tape in a small cassette, which can also be bought with 45 plus 45 or 30 plus 30 minutes of tape, or with even less of pre-recorded tape.

**DUMMY TRANSISTORS:** For some time, there have been stories about transistor radios which have included dummy transistors for the sole purpose of upping the count. That this goes on is in no doubt but just how widespread is the practice or how many manufacturers it involves is less clear.

While in Fiji recently I was offered a choice of portable radios with anything from six transistors to twelve or more, with the price escalating in rough proportion. Eight or nine yes . . . but I couldn't help but wonder how many of the transistors beyond that figure were really gainfully employed. I finished up buying an eight-transistor receiver of well-known make and, as far as I could judge from the radio-free interference in Nandi and Lautoka, it gave away nothing to others involving more transistors and more Fijian pounds.

The U.S. Federal Trade Commission is reported to be moving against any advertising that includes dummy transistors in the count, or reject transistors worth a few cents apiece which perform unimportant non-functional roles, or transistors used as diodes.

There is some question as to how far the F.T.C. should go and whether it should also ban separate count of transistors connected in parallel, or those performing auxiliary, non-amplifying functions such as fine-tune and AFC.

**FREQUENCY MODULATION:** Less than ten years ago, only about 10 per cent of all complete high fidelity systems sold in the U.S.A. included an FM tuner as an item of initial equipment. Undoubtedly, many tuners were added subsequently but how it would have modified the basic 10 per cent is not clear.

What is clear is that returns for

last year indicated that something like 80 per cent of all new, complete high fidelity systems included FM, the figure being slightly higher than the provision of record playing facilities. Proponents of FM have been quick to claim that the figures prove that more people now want FM than want records and that FM is displacing records as the accepted source of high fidelity signal.

But the record industry won't have a bar of this reasoning. They point out that the current fashion in hi-fi equipment offers an FM tuner in combination with an amplifier system that equals the performance of — and costs little more than — amplifiers without an inbuilt tuner. Who, therefore, wouldn't buy FM, when it is offered as a virtual bonus? FM, they rather rudely suggest, simply stands for "Free Music" And, what is more, the sales record of BM — Bought Music — shows that 10 per cent more was spent on records and pre-recorded tapes than was spent in 1966.

What the figures really prove is that more high-fidelity minded people are now acquiring FM facilities, whatever the reason. The FM programs themselves will determine whether the tuners are used or simply shuttle electrons around their solid-state circuits, while the operator listens to something else.

**TAPE SYSTEMS:** American market opinion seems to be that, despite the numbers of tape recorders in the hands of the public, tape has yet to make a real volume penetration into the pre-recorded high fidelity market. Only a small percentage of new equipments are sold complete with tape replay facilities; a percentage of buyers add them later but the total is still not impressive.

This is due largely to the fact that the availability and economy of good disc pressings has kept tape in the role of a rather unnecessary complication to the home system. And, further, the average reel-to-reel playing deck is not the kind of thing that manufacturers can accommodate easily or cheaply in a packaged home music system.

Cassette systems could change this, because they are small and development work on portable and auto type players has reduced the mechanism to the sort of thing that could conceivably be integrated with a disc player or with the amplifier itself. As with the FM tuner, once a cassette player can be offered as a bonus attraction, tape could "take off" in terms of public demand.

But like the FM tuner, cassette players would have to prove themselves in competition with discs in terms of convenience, economy and musical content.

There is one other aspect to this subject which I mentioned in a leader a couple of years ago. If tape systems take on in cars, there will be an added incentive to use them in the house as well.

**SUBJECTIVE REACTION:** What goes on anyway, when you expose your senses to the pressure waves from a loudspeaker, whether the said energy reaches you per medium of radio, record or tape?

Can the original sound environment

## WIRELESS WORLD: Fidelity or Felicity?

Debates about high-fidelity sound reproduction such as the one on loudness controls now proceeding in our correspondence columns, are potentially endless because they are basically "ideological." They are not concerned with demonstrable truths but with subjective questions — the beliefs, emotions, imagery, of separately evolved human beings — and consequently the points at issue can never be resolved. The debaters take up positions which are basically irrational and then proceed with great skill to rationalise them, thus convincing themselves of the logic of their arguments and becoming more and more fixed in their viewpoints. Long may this situation continue! In the case of the loudness-controls debate the existence of the loudness control seems to have forced a distinction between what is realistic to listen to and what is enjoyable to listen to. This is an unnatural situation because one feels sure that most people, including the debaters, really want both of these things.

It is proper for a journal concerned with other matters besides sound reproduction to step back and take a wider, cooler view. For example it is legitimate for us to consider sound reproduction as a communication process, in which the human "receiver" must be understood in terms of the psychology of perception. In the first place, then, it is obvious that the process cannot literally "reproduce" the original musical (or other) event. To do this is would be necessary to put the listener in an environment identical to that which he would have experienced if he had been sitting in the original concert hall. What is really happening in the listener's living room is that an electro-acoustic apparatus controlled from a record or from a distant radio transmitter, is sending out stimuli in the form of air-pressure variations. (And the loudspeaker doing this is certainly not an ideal transducer — a piston with zero mass, stiffness and friction — but more like the sounding board of a musical instrument being excited into a multiplicity of resonances by an electromechanical vibrator.) These stimuli are meaningless in themselves (in an unoccupied room they cannot be sounds) and only become truly signals in a communication process when they evoke responses in a human "receiver."

The "receiver" contains a store of experiential information about music that he has assembled himself over years of conscious and unconscious listening — the information being that a certain pattern of auditory nerve stimuli "means" a certain subjective response. While the "receiver" is thus interpreting and recognising the incoming stimuli he is simultaneously building a mental model, which is in fact the musical reality for him. He does this by continuously attempting to predict the musical structure from his store of information, while the incoming stream of stimuli continuously amends the details of the model. He may in fact ignore some of the signals because he wants his model to have a certain structure and these signals would not fit into it.

Thus, considered in this sense, the phenomenon is not so much one of reproducing reality but of assisting the listener to produce his own illusion of reality, by sending him skilfully devised stimuli. It is not a case of the listener believing what he hears, but of hearing what he believes is there. In a world in which make-believe plays such a significant part it is unrealistic to confine our attention purely to the physical characteristics of the stimuli produced by our electro-acoustic equipment. Neither fidelity nor felicity depends on these alone.

From "Wireless World," August, 1968.

be recreated so effectively that, for all practical purposes, you are present at the original performance?

An editorial from "Wireless World" reproduced at right, suggests that there is a fundamental error in the concept of recreating the original environment. That we are dealing rather in stimuli, which initiate a sound picture within the mind; the picture being rounded out by past experience and a positive rejection of stimuli which are inappropriate to the desired result.

Some may tend to reject this kind of thinking as high falutin' double-talk on the grounds that sound is sound, irrespective of whether the path from source to hearer has been interrupted by electronic gadgetry.

Against this, having spent a very pleasant evening in London with H. W. Barnard, editor of "Wireless World," I would be the last to expect him to deal in "high falutin' double-talk."

And I also have in mind that professional musicians, at least those of

the older school, are regarded as unreliable judges of electronic reproducing equipment. I have seen many of them quite absorbed in a reproduced performance, even though the standard of reproduction was plainly poor. One didn't need to be a psychologist to know that they were enjoying a musical experience beyond the limitations of the reproducing medium.

But having said this, it is difficult to avoid a further step into rather miry clay. If reproduced "sounds" can be relegated at one stroke to mere stimuli to a mental experience, a similar relegation must be considered for "sounds" at an original performance.

To what extent can an inadequate or poorly heard performance bring pleasure because it is of a work to which the listener has built up a strong emotional reaction? Is there the same (alleged) ability to reject what is inappropriate to the anticipated reaction?

A good subject for debate, next time you find yourself closeted with a group of high-fidelity enthusiasts.

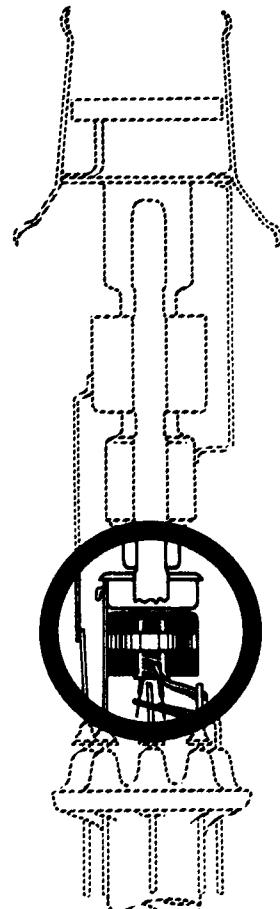
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WORTH OF CONFIDENCE?**

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Tubes - we now use the world's  
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QLD.: Gradwell & Co. Pty. Ltd.

S.A.: Radio & Electric Wholesalers Limited.  
W.A.: Simon Holman & Co.  
TAS.: W & G Genders Pty. Ltd.

**OFF-CENTRE CENTRES:** From a reader in Wavell Heights, Queensland, comes a letter in the following terms:

"Being fond of music, I have a large enough collection of records from many countries. I am not unduly concerned about the odd case of too high surface noise or rumble. These are only to be expected from the nature of the medium and can be accepted philosophically.

"But I cannot find any justification for the undue percentage of discs which do not have their hole in the true centre. As a result, I have too many wowing pianos and orchestral woodwinds, both of which are excruciating in a degree. I would estimate that 5 to 10 per cent of my records offend. It could be more.

"Surely accurate centring of the hole is fundamental to the operation and, unless I miss my guess, needs only to be checked once for a given batch of pressings. In my experience, it just isn't given enough attention. If, on the other hand, centring has to be checked for each pressing, I might be a little more tolerant. You can't argue with statistics.

"It would be interesting to know whether this is a general problem and whether it bothers other people as much as it does me. In the face of it the quoting of percentage of wow in turntables is little more than a giggle!"

What do others think about this?

Personally, I have noticed the occasional record which exhibits this effect, the wow being most apparent for tracks nearer the centre. I would be surprised, however, if the percentage got anything like as high as 10 or even 5.

And maybe the turntable can't be let off quite as easily as our correspondent suggests. Granting that practical turntables and practical records will contribute some wow, it may well be that the effects may add or cancel quite randomly, depending on the way on which a given record is placed on a given turntable.

Another effect which can occur with very light turntables is that they can slow up perceptibly under the drag of a heavier cartridge playing a deeply modulated passage.

**WHEN IS A CATHODE?** A reader from Warradale, S.A., writes: "Further to the discussion in Forum on Primary Cells, I would like to draw attention to Chambers' Technical Dictionary, 1961.

**ANODE:** The electrode through which a current enters an electrolytic cell, gas discharge or a thermionic valve, from an external source of electromotive force.

**CATHODE:** The electrode through which a current leaves an electrolytic cell, etc.

**ELECTRODE:** A conductor whereby an electric current is led into a liquid (as in an electrolytic cell) or into a gas (as in a gas discharge tube).

"After discussing the article and the above with several friends who are well acquainted with electronics, I have come to the conclusion that the carbon rod in a carbon-zinc cell qualifies quite well as a cathode.

"To settle the whole matter, it would seem that we have to agree on the question: What is the currently accepted definition of the above terms?

## METER CHECKS RADIATION HAZARD



This radiation monitor should be of interest following recent discussion in these columns (August, 1968) on the subject of radiation.

Marketed by the Narda Microwave Corporation, Plainview, N.Y. 11803, U.S.A., the new "Hazard Hunter" is a light weight, portable, direct-reading device that locates and measures electromagnetic radiation from industrial microwave devices, all types of transmitters and laboratory equipment. The instrument can detect radiation in all planes with a single antenna.

It weighs only three pounds including batteries. Accuracy is claimed to be within  $\pm 2\text{dB}$ , or  $\pm 1\text{dB}$  with correction factors. It has a midscale reading of  $10\text{mW/cm}^2$  with a red signal indicating danger to personnel above that reading. Designed for use under Arctic or tropic conditions, it operates from  $-40^\circ$  to  $+120^\circ\text{F}$ .

"Finally, a pat on the back for an excellent magazine."

(R. M. Warradale, S.A.)

This letter is reproduced, not because it contributes anything radically new to the discussion but because it is typical of others which we have received and which indicate group discussion.

It is amazing how ideas and expressions can be sustained for years within an industry or science before anyone thinks to challenge them seriously. The two in question: Is the term carbon-zinc acceptable as a name for the common dry cell? And: Should the carbon rod be referred to as the cathode?

R.M.'s final question has about it an "Alice in Wonderland" quality. All we need to do to resolve the problem is to settle the matter. That, R.M. is the hard part!

The term carbon-zinc is widely used, easy to remember, easy enough to say and everyone knows what it is supposed to mean, even those who don't like it. It could only be displaced by a term which has so much merit in all essential directions that the majority would elect to use it.

As for the definition of the cathode, Chambers' Technical Dictionary is one of the many references which can be turned up to support one point of view or the other. And references are still turning up.

One new book which we reviewed recently gave the carbon rod as the cathode. Another went to some trouble to stress that it wasn't!

But even in the face of continuing contradiction, discussion like this isn't wasted. It discourages automatic acceptance of the particular terms, encourages closer examination and paves the way to change, where this seems appropriate.

**RADIO SERVICEMEN:** From Western Australia comes a letter in the following terms:

"Enclosed is a cutting from a W.A. newspaper which you might like to

comment on or pass to the Serviceman.

"To my way of thinking, this sort of advertising does nothing for the image of the trade and should be condemned. I am not a serviceman, by the way!"

(P.C. South Perth, W.A.)

### HOW TO STOP HATING TV REPAIR MEN

It's simple — avoid them. They cost you money.

Keep you waiting.

Talk technical talk you couldn't follow in a fit. So, friend, give up.

Don't fight it. Rent TV from —

Since P.C., who is not a serviceman, has reacted this way, it is reasonable to assume that he is not alone. To be sure, the service industry has enough problems of its own without having to cope with a shadow cast by unsympathetic advertising. ■

## BULGIN SWITCHES



For all applications.  
Send for List Nos: 8.700-787

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**R.H. Cunningham** PTY. LTD  
608 COLLINS ST., 64 ALFRED ST.,  
MELBOURNE, MILSON'S POINT.



# WARBURTON FRANKI

## RESISTORS

MADE IN WEST GERMANY BY ROSENTHAL

1 Watt	Precision	Carbon	Type	$\pm 1\%$
VALUES IN STOCK				
15	180	5600	39K	600K
22	220	6000	40K	680K
24	240	6800	47K	700K
27	270	7500	68K	750K
33	330	8000	75K	800K
39	560	13K	80K	820K
47	800	15K	220K	1.2 meg
56	820	18K	270K	1.8 meg
68	2400	22K	330K	3.9 meg
82	2700	25K	390K	5.6 meg
120	3900	27K	400K	6.8 meg
150	4000	30K	560K	

25c each or \$2.50 doz. or \$17.50 per 100.  
Prices include postage.

## PHILIPS ELECTROLYTIC CONDENSERS

(Made in Holland)

### VALUES AVAILABLE

100 mfd	2.5 VW	200 mfd	6.4 VW	160 mfd	16 VW
125 mfd	2.5 VW	320 mfd	6.4 VW	640 mfd	16 VW
640 mfd	2.5 VW	800 mfd	6.4 VW	1000 mfd	16 VW
800 mfd	2.5 VW	2500 mfd	6.4 VW		
1250 mfd	2.5 VW			125 mfd	25 VW
200 mfd	4 VW	64 mfd	10 VW	640 mfd	25 VW
500 mfd	4 VW	160 mfd	10 VW		
640 mfd	4 VW	250 mfd	10 VW	1 mfd	40 VW
40 mfd	6.4 VW	400 mfd	10 VW	16 mfd	40 VW
160 mfd	6.4 VW	1600 mfd	10 VW	64 mfd	64 VW

Lots of 100 assorted \$19.75 or \$2.75 doz.  
Prices include postage.

## SPECIAL CONDENSER POLYPAC

No. 20

Contains 25 assorted condensers, including ceramic, electrolytic, metal pack, mica, paper tubular. \$1 plus postage 5c (or 6 for \$5.50 including postage).

## 807 VALVES

AMERICAN SYLVANIA, \$1.75 each, includ. post.  
Packs of 10 \$15.00 including postage.

## TELECALL-Mini Door-Phone

### 2 MODELS:

1. WITH FLUSH MOUNT SLAVE UNIT (Stainless Steel).
2. WITH SURFACE MOUNT SLAVE UNIT. (Plastic).

Normally used to communicate with visitors at front or rear door from kitchen, etc., or may be used as a high quality intercomm. between any two locations. Supplied complete with battery and 50ft wire.

**\$11.95**

Either Set. Post free.

SURFACE MOUNT TYPE      FLUSH TYPE



## PHILIPS RE2 RADIO ENGINEER KITS

Everything supplied to build a 3 transistor mantel radio including cabinet. The radio may also be used as an amplifier for a record player or microphone. Price while they last, including batteries and freight.

**\$17.95**

## FONET TRANSCEIVERS 102B

- ★ Citizens Band, 27.24 m.c.
- ★ 10 Transistors.
- ★ Battery Power Meter.
- ★ Power Input 240 m.w.
- ★ Approved by P.M.G.

PRICE PER PAIR      **\$69.95** Freight free.

## 4m.m. EARPHONE PLUGS

With 45" twin flex attached . . . . **12c.** each.

Packs of 10      **\$1.00** including postage.

## POWER SUPPLY BASIC KIT

Consists of: One Transformer tapped for 9v and 12v at 500 ma. One full wave contact cooled Rectifier. One 1,000 mfd 15 V.W. Capacitor.

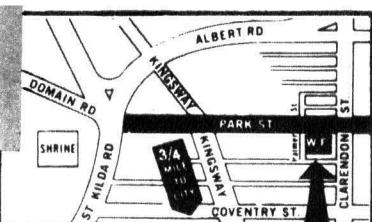
Make your own 9 or 12-volt power pack to supply transistor radios, record players, slot cars, toys, etc.

Supplied with wiring diagrams. **\$3.50** Post free.



# WARBURTON FRANKI

220 PARK ST., STH. MELB., VIC. Ph. 69-0151 (30 lines)



# Adapt Your Radio to Double as an Intercom!

Details of simple adaptation circuitry which will allow almost any domestic broadcast receiver to double as two-way intercom or monitor system. Just the idea for providing an audio link between the house and a garage or "ham shack."

by Jamieson Rowe

If you want to provide a two-way audio link between your house and garage or workshop, or to give your wife a monitor system which will allow her to listen for baby's wail while she is in the kitchen or sewing-room, there's probably no need for you to buy or build a complete intercom set for the job. Most likely you already possess about half of the necessary hardware of such a system, in potential form: the audio amplifier section and the loud speaker of a standard domestic radio receiver.

All one has to do, in order to allow the radio to double as a useful intercom or monitor, is add the simple adaptor circuitry described in this article. The conversion is straightforward, requires little effort, and — most importantly — will involve a

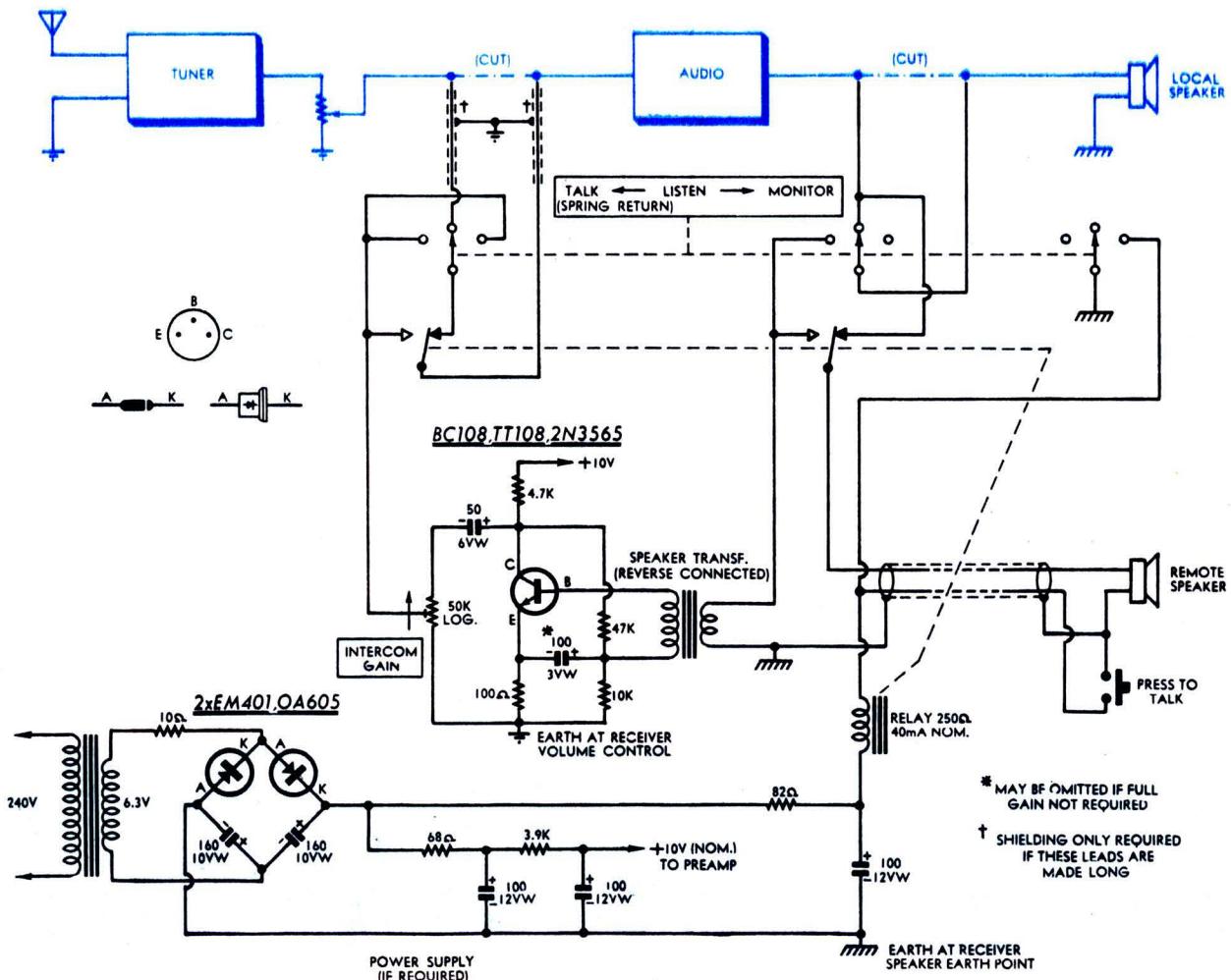
minimum outlay. With some receivers, the cost will be no more than two or three dollars, or even less if some of the parts are salvaged from the "junk box."

The adaptor circuitry consists basically of a remote speaker, a step-up audio transformer, and a simple switching system incorporating a relay. In addition to these may be required a small one-transistor preamp, in cases where the receiver audio section has inadequate gain, together with a small auxiliary power supply necessary if the relay cannot be energised by the receiver power supply.

The full schematic of the adaptor circuitry is shown in the main diagram, with the basic sections of the existing receiver shown in block form. As may be seen, there are only two points

at which are connections to the existing circuitry, one being at the rotor of the volume control pot while the other is at the loudspeaker voice coil.

There are two switch elements connected to the receiver circuitry at the volume control rotor and audio section input; one element is part of the "local" intercom function switch, while the other is a changeover contact set actuated by the relay — which performs the "remote" function switching. Both switch elements are connected such that when both "local" and "remote" stations are in the "listen" mode, the tuner output is fed to the audio section in the normal fashion. However, if either station is switched to the "talk" mode, or the "local" station is switched to the "monitor" mode, the tuner output is disconnected and sig-

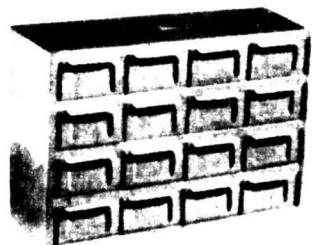


## CHEST OF DRAWERS

Three types of Galvanised Chests measuring 17½in x 6½in x 11½in, containing 16 drawers, each measuring 6½in x 3½in x 2½in.

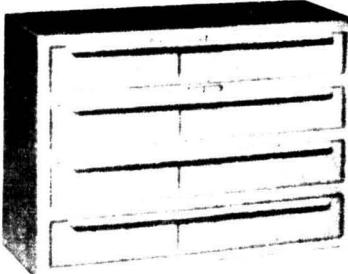
- TYPE C.D.1. With 16 undivided drawers, \$7.00.
- TYPE C.D.2. With 16 triple compartment drawers, \$8.00.
- TYPE C.D.3. With 8 triple compartment drawers, and 8 undivided drawers, \$8.00.

The Chests are finished in blue hammer tone stoving enamel, are complete with identification cards and packed in strong corrugated cartons. Provision is made for all units to be bolted together in tiers.



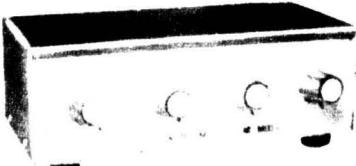
## CHEST OF DRAWERS TYPE C.D.4.

A 17½in x 6½in x 11½in Galvanised Chest containing 4 full-length drawers each measuring 13½in x 6½in x 2½in. Finished in blue hammer tone stoving enamel. \$7.00.



WRITE FOR FREE CATALOGUE AND PRICE LIST OF TOOL BOXES AND CHEST OF DRAWERS.

## MODEL M6 FOUR CHANNEL TRANSISTORISED MICROPHONE MIXER



All four inputs accept standard two circuit Phone Plugs, while the output jack accepts a standard circuit Phone Pin Plug.

### SPECIFICATIONS:

- Input Impedance: "Hi" Impedance for Crystal Microphone, etc. • Gain: Approximately 6 db. • Maximum Input Signal: 1.5 volts. • Maximum Output Signal: 2.5 volts. • Output for Minimum Distortion: 2 volts. • Hum: 0. • Battery: 9 volts.

Mono \$6.75 Stereo \$9.75

## BELLPHONE



Pick up the receiver and dial push number desired.

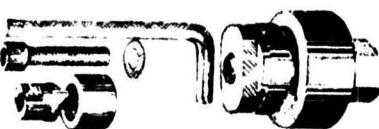
Price \$9.00 per pair

## KALTRO SVC TV-RADIO REMOTE CONTROL LISTENER



This TV-Radio Remote Control Listener is a combination of an extension speaker and a remote control station to regulate the sound of both the TV, Radio, Phono, or Hi-Fi set and the speaker incorporated in the Listener itself. In addition, up to two earphones can be attached for listening to the sound of the TV, Radio, Phono, or Hi-Fi set without disturbing others around you. Unwanted commercials can be easily cut off by merely turning down the control of the TV-Radio Remote control Listener. A modern designed plastic cabinet with easily adjustable fingertip controls ideal for use in home, office and business. Complete with earphone, 20ft of lead wire and installation instructions.

Price \$8.75



## "PIPGRAS" HOLE PUNCHES

"PIPGRAS" Hole Punches are made from Alloy Tool Steel, and cut clean and accurate holes in sheet metal. They make a smooth, perfect hole without reaming or filing.

## SCREW TYPE, ROUND

Supplied with "UNBRAKO" High Tensile Socket Screws and Wrenches. Cut holes in sheet metal up to 18 gauge.

Type	Nominal Size	Actual Size (D.)	Water Pipe	Pilot	Price
32.S	1/16in	0.507in	—	1/16in	\$2.17
40.S	5/32in	0.618in	1/16in	5/16in	\$2.17
48.S	3/16in	0.742in	3/16in	5/16in	\$2.80
56.S	7/32in	0.884in	2/16in	3/16in	\$3.80
64.S	1in	1.008in	—	3/16in	\$4.10
72.S	1 1/16in	1.133in	3/16in	5/16in	\$4.53
76.S	1 1/3/16in	1.172in	—	3/16in	\$4.53
80.S	1 1/4in	1.258in	—	3/16in	\$4.97
88.S	1 3/16in	1.382in	1in	7/16in	\$5.97

With Heat Treated, High Tensile Steel Hex. Head Bolt and Nut.

Cut holes in sheet metal up to 16 gauge.

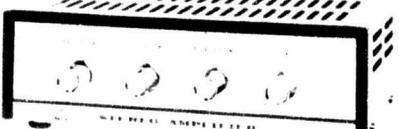
96.S 1 1/2in 1.512in 9/16in \$6.68

112.S 1 3/4in 1.762in 1 1/4in 9/16in \$7.60

128.S 2in 2.014in 1 1/2in 9/16in \$8.33

AM-V320 Upright.

## 8 WATT STEREO AMPLIFIER MODEL SA-805 OPERATING MANUAL



### SPECIFICATIONS

Output Power: 8 Watt, 4 Watts per channel.

Frequency Response: 60 to 15,000 cps. plus or minus 1 db.

Harmonic Distortion: Less than 3%.

Hum and Noise: 52 db below rated output.

Sensitivity: Phone (Crystal) 100mV 250K ohm.

Tuner 100mV.

Tube Complements: 12AX7x1, 30A5x2, 1S315x1 (Silicon Rectifier).

Dimensions: 5.1lb, 9 3/4in x 6 1/4in x 3in.

Price \$35.00

## "PALACE" SOLID STATE STEREO AMPLIFIER Model AM-320



Power Output: 16W (8W per channel).

Frequency Response: 80-10,000 cps plus or minus 1dB 1W; 50-20,000 cps plus or minus 2dB 1W.

Harmonic Distortion: Less than 2% at 3W; less than 4% at 3W; less than 4.5% at 8W.

Tone Control: Bass plus or minus 10dB at 50 cps. Treble plus or minus 10dB at 10,000 cps.

Loudness Control: Plus 6dB at 50 cps; plus 4dB at 10,000 cps.

Input: Tape head 3.5mV; Mag. 3.5mV; Cer. 100mV; Tun., Aux. 150mV.

S/N Ratio: Minus 45dB.

Transistor complement: 2SB347 x 2, 2SB345 x 8, 2SB481 x 4.

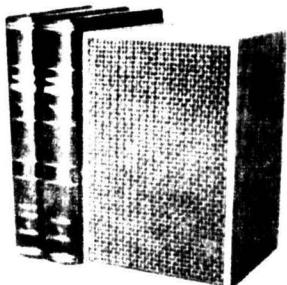
Power Supply: 117V AC 50-60 cps.

Dimensions: 10 1/4in (W) x 3 1/2in (H) x 8 1/4in (D).

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nals from the appropriate station connected to the audio section input.

At the receiver voice coil circuit there are three switch elements, two of which form the remainder of the "local" intercom function switch while the third is a second changeover contact set actuated by the "remote" relay. The first and third switch elements are used for switching of the actual speakers; when both stations are in the "listen" mode, the speakers are connected in parallel across the receiver audio output. In this mode the system thus behaves purely as a radio receiver, the "remote" intercom station acting as an extension speaker.

When either station is switched to the "talk" mode, the corresponding speaker is disconnected from the output of the audio section and routed to the input, via a reverse-connected speaker transformer, the preamp (if used) and the input switch elements. Hence, either station can communicate at will to the other, by interrupting the radio program material.

A separate gain control fitted to the intercom input circuitry allows the receiver volume control to be adjusted quite independently of the intercom system, so that if desired the radio program may be turned well down or even right off without affecting the intercom volume or sensitivity.

The "local" function switch is a 3-pole three-position switch, preferably one in which one position ("talk") is provided with a spring-return action. A suitable switch is available from the range marketed by Manufacturers' Special Products Pty. Ltd., being known as a type "LH" lever switch. Similar switches may also be available from disposals stores.

The third position of the "local" switch is used to provide the "remote monitor" function. By causing the remote station speaker to be connected to the input of the system, this position allows the unit to be used for monitoring and "baby minding" under full control of the local station. Hence, mother can enjoy her favourite musical program or soap-opera in the kitchen or sunroom, interrupting it only briefly every now and again to listen for possible "trouble."

The relay, which performs "remote" station-switching is a low voltage, low current type, operated by a simple "press to talk" push-button at the remote station itself or alternatively by the third pole of the "local" switch in the "monitor" position. As may be seen, the use of a relay simplifies the intercom-switching and allows the use of relatively economical two-core shielded cable to the remote station.

Although almost any relay providing two changeover contact sets could be used, units having either very high or very low resistance coils would pose power supply problems; for this reason we are suggesting a relay having a nominal 250 ohm coil and requiring a nominal actuating current of around 40mA. A suitable relay, which is also quite readily available from trade suppliers is marketed by Standard Telephones and Cables Pty. Ltd., having the code number "250.AKO."

The step-up transformer used to couple the intercom speakers to the input of the receiver audio amplifier may conveniently be a standard speaker transformer used back-to-front. The impedance ratio of the transformer is not especially critical, although for

best efficiency it should have a fairly high ratio. A small low-powered rating transformer will be quite adequate, and will in fact be an advantage as the transformer must be kept away from the receiver power and output transformers to obviate hum and magnetic feedback problems. If close spacing is unavoidable, the transformer may have to be orientated for minimum coupling.

In cases where the gain of the receiver audio section is sufficiently high, the secondary of the step-up transformer may be connected directly to the intercom gain control. However, with receivers having a single audio stage, this connection will most likely give inadequate intercom gain, and it will be necessary to employ the simple, one-transistor preamp stage shown. The transistor employed may be almost any general-purpose NPN silicon type, suitable devices being the BC108, TT108, TT3565, 2N3565, AS311 and AT322.

The pre-amp circuit shown is a simple common-emitter stage using transformer input coupling. If the full gain is not required, the 100uF 3VW electrolytic between the emitter and the "cold" end of the transformer secondary may be omitted. Power requirements for the preamp are a modest 10V (approx.) at 1mA, which may be derived either from the receiver circuitry or from the relay power supply shown.

The power supply itself is a simple "full-wave" voltage doubler circuit, connected to a source of 6.3V AC. The AC may be taken from a heater winding on the receiver transformer, if this is convenient, or alternatively from a separate transformer as shown. If a separate transformer is used, it should preferably be a small or miniature type (the current drain will be no more than 45-50mA at most).

Where the local and remote stations are to be separated by a long distance, it is recommended that the remote speaker be of 15 ohms impedance to reduce cable resistance losses. In such cases it may also be advantageous to fit a 15-ohm speaker to the receiver, to balance the gain of the intercom in both directions. Although this may introduce some mismatch into the receiver output coupling the effect upon performance will in most cases be negligible.

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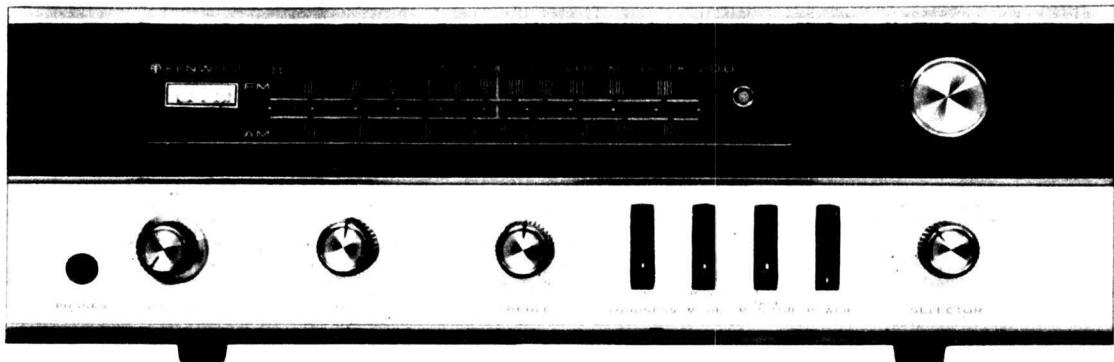
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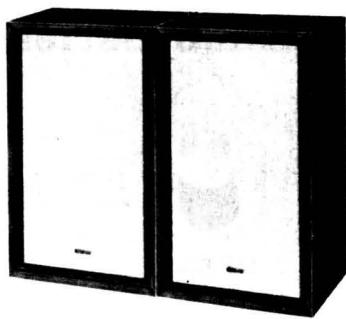
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\*DIMENSIONS: 14½"(W), 4¾"(H), 11¼"(D)

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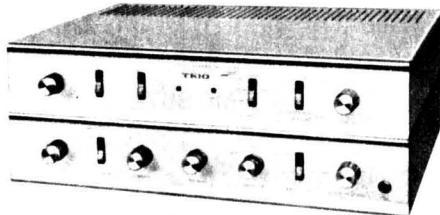
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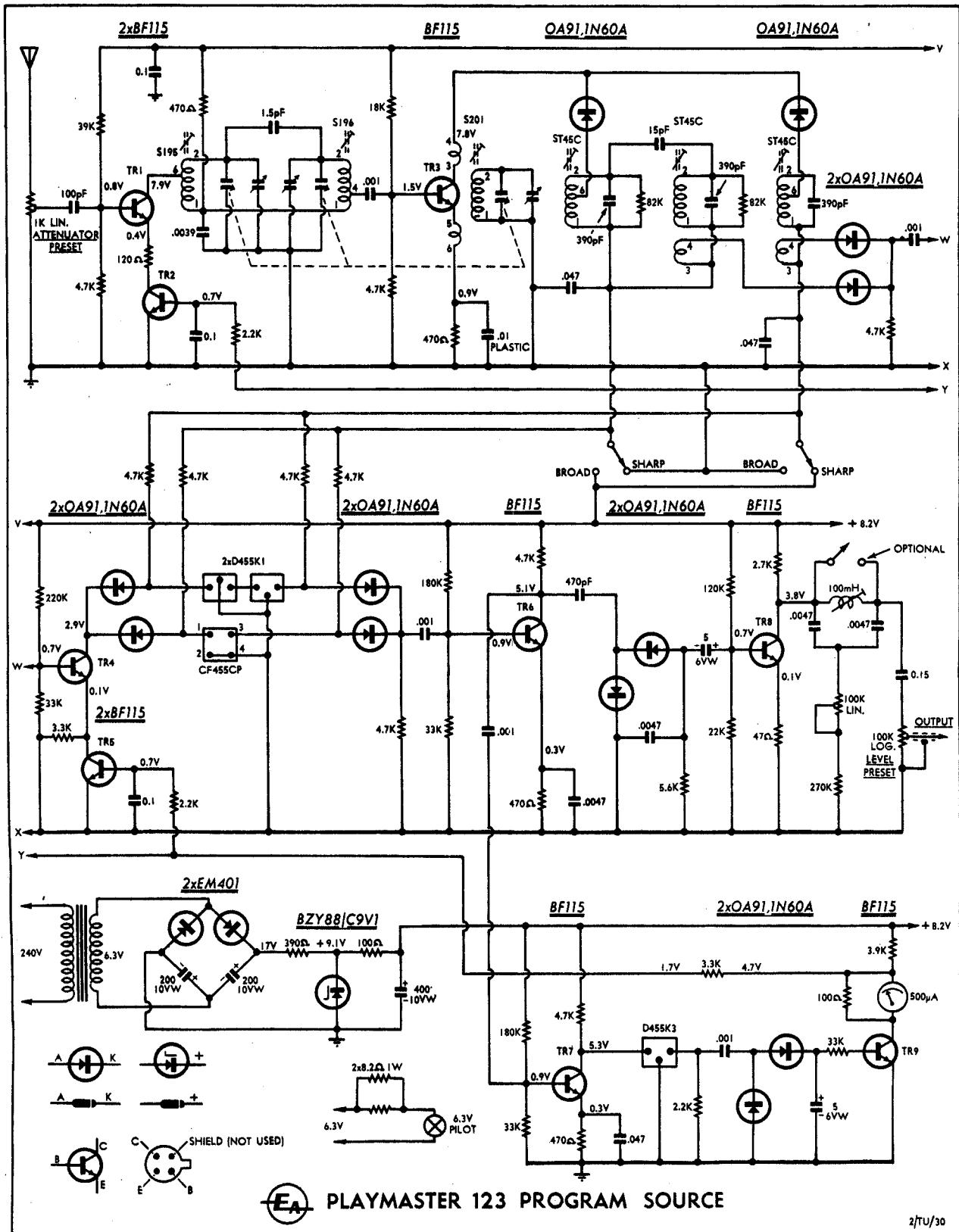
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a problem. The response curves show the difference with the whistle filter in and out of circuit.

As the level of audio from the whistle filter is more than necessary for most amplifiers, a 100K pre-set potentiometer is also provided. This can be adjusted to suit the amplifier sensitivity.

For AGC purposes, some of the signal is picked off the collector of the second IF amplifier (TR6). This sig-

nal is fed via a .001uF capacitor to a buffer-amplifier stage (TR7). Following this amplifier is the 8KHz ceramic filter already mentioned. The function of this filter is to retain a peaked response in the AGC system, even when the tuner is switched to the broad position. This is necessary in order that the tuning meter will provide an unambiguous indication of correct tuning. The filter is deliberately selected to be as broad as possible,

consistent with a distinct peak, in order to minimise overload (and possible distortion) which may be evident at the "edges" of the pass-band as the set is tuned across a station, while in the broad position.

The signal for AGC is detected in a voltage-doubler diode arrangement and the recovered DC is used to drive the base of the AGC amplifier (TR9). Under no-signal conditions this amplifier has no forward bias applied, the

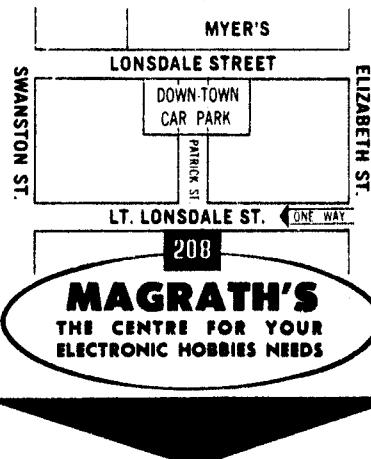
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collector current is very small, and the tuning meter shows practically no reading. When a signal is received, the voltage applied to the base is in proportion to the strength of the signal. The transistor conducts accordingly and the collector current is shown on the tuning meter.

As the maximum current through the meter can be in excess of the rating of the movement, the coil is shunted to give a full-scale reading on very strong signals. The meter which we used on this occasion, is type No. A-304, the sensitivity being 500 $\mu$ A and the resistance 250 ohms.

Above the tuning meter is the 3.9K AGC amplifier load resistor. From this point, the AGC is fed to the base of each of the two control transistors (TR2, TR3), one each in the emitter of the RF amplifier and the first IF amplifier. This line provides a forward bias for the base of each control transistor so that, under no-signal conditions, it is fully conducting. The voltage across these transistors and therefore the resistance in the emitter of the respective amplifier is quite low. Under these conditions, there is very little negative feedback.

When a signal is received and the voltage at the collector of the AGC amplifier falls, the forward bias on the control transistors is reduced. The collector-emitter resistance increases, giving rise to negative feedback, which reduces the gain of the controlled amplifiers.

The power supply components, with the exception of the transformer, are built into the printed board. Transformers for this job were discussed in some detail in last month's issue. If you intend to follow the full-wave voltage doubler circuit as shown on the main circuit, any transformer capable of delivering 6.3 volts at 0.6 amp will be suitable; in the prototype, we used a type PF2315, made by Ferguson.

The voltage doubler circuit produces a DC voltage in excess of that required. The 390 ohm resistor and the zener diode reduce this voltage and regulate it to a nominal 9.1 volts.

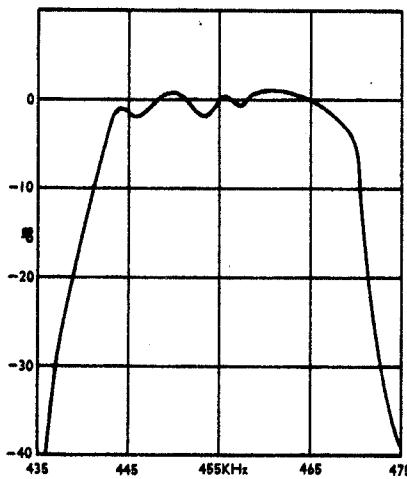
Provision is made on the board for alternative power supply arrangements and these were detailed last month.

In the same article, we explained how the wide-band ceramic filter could be replaced with back-to-back IF transformers, similar to the arrangement used for the previous stage.

The AGC characteristics for both narrow and wide selectivity positions are shown. It can be seen that the sensitivity is useful for signals with a level of only a few microvolts—this with the aerial input attenuator turned fully up. By adjustment of the attenuator, signals of up to one volt or so can be handled.

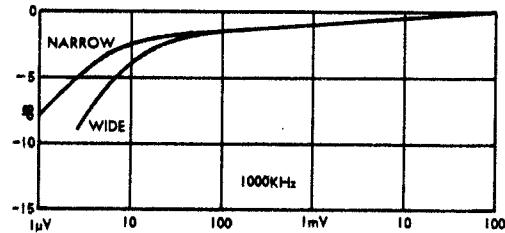
Construction is relatively straightforward for a unit of this order of complexity. Perhaps the best place to start is the assembly of the printed wiring board. All the components are identified on the coded photograph.

The six coils may be mounted first and soldered into place, making sure that the assembly is properly seated on the board. The filters are next, with the same precaution to be taken. There are five links to be fitted to the board; four of them may be of tinned copper, but the one nearest the oscillator coil should be of insulated hookup wire.

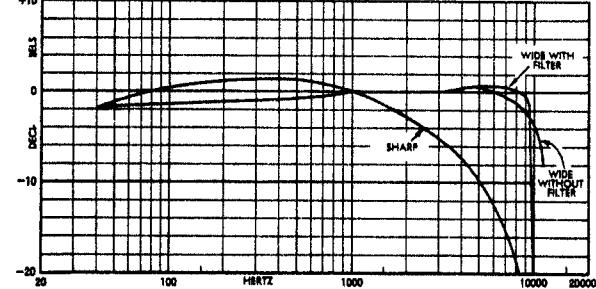


A response curve, taken in our laboratory, of the CF455CP ceramic filter used in our prototype tuner. It easily satisfies the 20KHz bandwidth requirement.

The AGC characteristic of the tuner for both wide and narrow positions. A pre-set aerial attenuator extends the signal range in high signal level areas.



Response curves showing performance in the narrow position and in the wide position at 600KHz, both with the whistle filter in and out of circuit.



Resistors and capacitors are next. Make sure that the electrolytics are fitted in the correct polarity. When fitting the diodes—there are fifteen in all—take care not to overheat them. Again, correct polarity is important. Reversed polarity may lead to damage in some instances or, at best, failure of the circuit to function correctly.

Fit the gang lugs through the holes provided and take care that the assembly is seated properly on the board. There are seven potts which have to be soldered. As they are all rather heavy connections, a hot soldering iron, applied for sufficient time is needed to make a good joint. Avoid overheating, however, as this can be detrimental to the board and adjacent components. Now solder the 1.5pF top-coupling capacitor across the end lugs on the top of the gang.

The only components left are the transistors. Once again, take care to solder without overheating. It is also vital to be quite sure that the right connections are made. In the case of the BF115, there are four leads, one a shield and normally connected to

earth. In this application shielding is not required and we simply bent this lead upwards and left it at that. The mixer-oscillator transistor, close to the gang, should be so bent that the rotors of the oscillator section of the gang will clear it by an eighth of an inch.

Nine leads of hookup wire have to be soldered to the board, the lengths depending on their ultimate destination. The leads are: One each for the aerial input and audio output, one for the whistle filter, a pair for the tuning meter, and the remaining four for the selectivity switch.

The whistle filter may now be mounted at the top right corner, near the audio output. The filter assembly, on its own printed board, is stood off the main board with two one-inch spacers, threaded at each end. This allows ample clearance underneath.

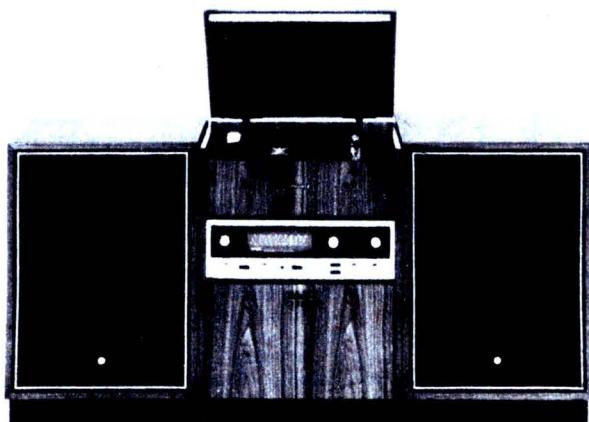
Having mounted the filter, connect the lead from the main board to the lug at the outside edge of the filter board. Fit the 0.15 $\mu$ F capacitor from the other lug on the filter board to the hole in the main board which is

just behind the output potentiometer. The 270K resistor is connected between a hole in the main board (directly underneath the outside edge of the filter) and the rotor of the filter potentiometer.

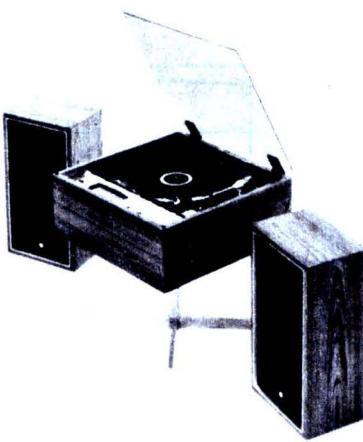
Connect the four leads to the selectivity switch, according to the diagram. Connect the other two leads to the meter, with due regard to polarity. It is also necessary to connect a shunt resistor directly across the meter terminals. The value which we found to give full-scale deflection on very strong signals, was 100 ohms.

At this stage, the time is right for the assembly of the major sub-assemblies. The printed board assembly is fixed to the metal chassis with seven screws. When mounting the board, it must be stood off by about 1/8in so that no interconnections or soldered joints can short-circuit to the chassis. Spacers, washers or nuts may be used to stand the board off sufficiently.

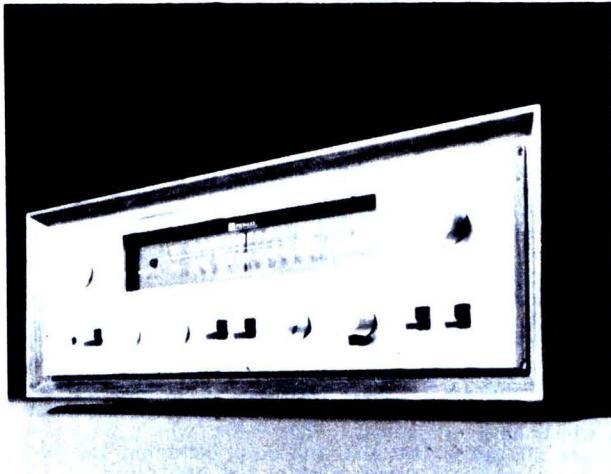
Aerial and earth terminals are fixed to the back skirt of the chassis. If you fit the optional whistle filter



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switch, it is also mounted on the back skirt of the chassis and just below the filter. The audio output lead, which should be of low capacitance microphone or coaxial cable and preferably no longer than two feet, is terminated on a 3-tag strip on the back skirt of the chassis. Both the centre conductor and the braid are terminated to insulated tags on the strip. The centre conductor is extended to the audio output point on the board, while another wire is run from the braid, to the board holding screw at the centre rear of the board.

The power transformer is mounted on the chassis, at the power supply end of the board. The 240 volt primary leads are terminated on a 4-tag strip underneath the chassis. The power cord is brought through a grommet in the chassis back skirt and terminated on the strip. The ON/OFF switch is wired also to this strip. The 6.3 volt winding is terminated on a 4-tag strip on top of the chassis. From here, leads are extended to the 6.3 volt input to the power supply on the board. In addition, we have included two 8.2 ohms 1W resistors in parallel on this strip. They are wired in series with the supply to the two dial lamps on the front panel. The idea is to reduce the voltage which is somewhat more than nominal and so increase the life of the lamps.

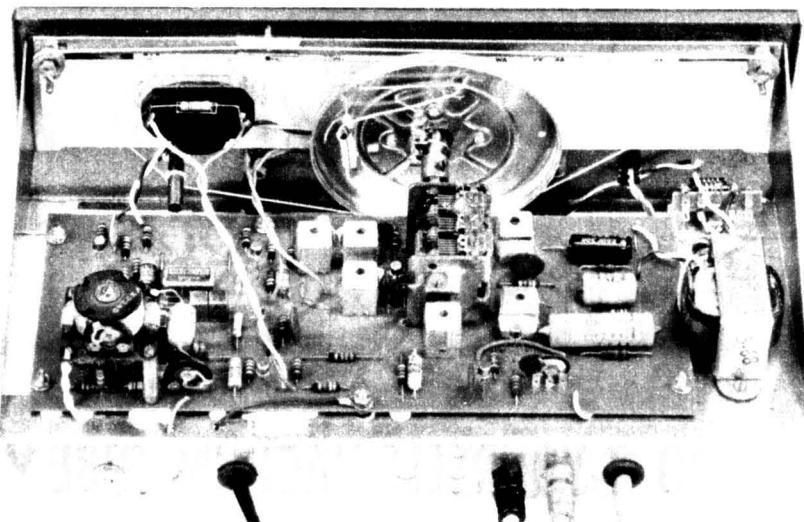
Before proceeding with the front panel assembly, fit the extension shaft and dial drum to the gang spindle. It will be necessary to shorten the extension shaft and this can best be determined on the job. It must clear the white dial scale backing plate.

The front panel assembly can be a little tricky, but it should present no problems if it is approached systematically. Do not attempt to fit the panel overlay at this stage. There are two fixing screw holes at each end of the front panel and these mate with corresponding holes in the chassis end brackets. Fit the chassis and panel together loosely, with the bottom hole at each end, using short counter-sunk screws. Use  $\frac{1}{8}$ in long screws for the two top holes and screw them up tight. The bottom screws may also be tightened.

Locate the two toggle switches and the drive spindle loosely on the panel. Two dial lamp socket brackets should also be fixed to the panel. These consist of two pieces of 18-gauge metal,  $2\frac{3}{8}$ in long x  $\frac{3}{8}$ in wide. On assembly, they will need to be offset slightly, so that the lamp sockets may be slid into place.

Lay the unit so that the front panel is face down. The glass dial scale must be carefully located in its correct position. Drop a clamp plate, one over each of the top fixing screws. A piece of soft material must be placed between the clamping plates and the glass to prevent breakage; we used small pieces of foam plastic. The glass may now be clamped into position. The white scale backing plate is also held with these screws. However, sufficient spacers must be used to stand the plate off such that there is  $7/16$ in between the plate and the back of the panel.

Two other holes, one each located immediately above the mounting holes at each end of the panel, are used for the dial pointer slider bar. Screws at least one inch long are needed here. Slip the pointer assembly on the



This top view shows clearly the layout of the major components, with the power transformer on the right and the whistle filter at the bottom left corner. The dial stringing can also be seen.

slider bar. Now mount the bar, using  $3/8$ in long spacers, so that the pointer will just clear the dial scale. A couple of nuts at each end of the bar may be used for fixing and providing more spacing. A  $\frac{1}{8}$ in long bush, with a dial cord pulley, is fitted above the spacing nuts. Finally, the pulley bushes are held with one nut for each.

The front panel overlay may now be fitted and it is held in place by the nuts of the bushes on the two toggle switches and the dial drive. The tuning meter is fitted into the rectangular hole in the dial backing plate. It is inserted into the hole as far as possible, to the point where the pointer just clears the meter face. A small

quantity of cellulose adhesive may be used to hold the meter in position.

The dial stringing is easy and straightforward. With the gang closed, tighten the extension shaft and tighten the drum with the cord outlet holes pointing towards the low frequency end of the dial. The drum must be so located on the shaft, such that it gives sufficient clearance to the selectivity switch lugs. This means that the drum will be slightly offset with respect to the two dial cord pulleys. The cord is strung along the length of the slider bar, over the pulleys, twice round the drive spindle, with this end  $\frac{1}{2}$  turn around the drum and then terminated. The other end makes a

## PARTS LIST

1 Set of metalwork.	1 $\frac{1}{4}$ in extension shaft.
1 Printed board, No. 68/8t.	RESISTORS ( $\frac{1}{2}$ W 5pc unless stated otherwise)
1 Dial kit.	2 8.2 ohm 1W 10 4.7K
1 Knob.	1 47 ohms 1 5.6K
1 Miniature toggle switch, SPST.	2 100 ohms 1 18K
(optional, see text).	1 120 ohms 1 22K
1 Miniature toggle switch, DPDT.	1 390 ohms 4 33K
1 Meter 500uA, type A-304.	4 470 ohms 1 39K
1 Power trans. 6.3v 1A (see text).	3 2.2K 2 82K
1 Whistle filter assembly, No. 129.	1 2.7K 1 120K
1 Roblan paddleless gang, with trimmers.	2 3.3K 2 180K
1 Coil (band-pass pair) S195.	1 3.9K 1 220K
1 Coil (band-pass pair) S196.	1 270K
1 Oscillator coil S201.	CAPACITORS
3 IF transformers ST45C.	1 1.5pF NPO ceramic.
1 Murata ceramic filter CF-455-CP.	1 15pF NPO ceramic.
2 STC ceramic filters EFC-D455K2, 1 STC ceramic filter EFC-D455K4 (matched set).	1 100pF plastic or ceramic.
1 1K linear pre-set tab pot.	1 470pF plastic.
1 100K linear pre-set tab pot.	5 .001uF low voltage plastic.
9 BF115 transistors.	1 .0039uF low voltage plastic.
12 OA91, IN60A diodes.	2 .0047uF low voltage ceramic.
2 EM401 diodes.	1 .01uF low voltage plastic.
1 BZY88/C9V1 zener diode.	3 .047uF low voltage ceramic.
2 Stand-off pillars, 1in long, threaded each end.	3 .1uF low voltage ceramic.
2 Dial lamp sockets (insulated).	1 0.15uF low voltage plastic.
2 Dial lamps, 6v.	2 5uF 6VW electrolytics.
2 Terminals, 1 red, 1 black.	2 200uF 10VW electrolytics.
1 3-tag strip.	1 400uF 10VW electrolytic.
2 4-tag strips.	SUNDRIES
	Hook-up wire, solder lugs, solder, microphone cable, 3-core power flex, 3-pin plug, screws, nuts, etc.

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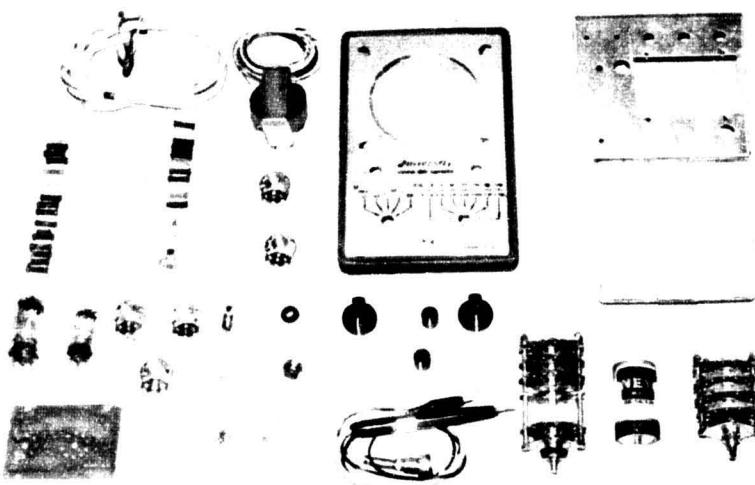
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little over  $\frac{1}{4}$  turn around the drum and it is terminated with the spring. Sufficient tension should be arranged so that the drive is smooth and positive.

Before proceeding further, a thorough check should be made to be sure that there are no errors or omissions. Assuming that all is well, connect the audio lead to the amplifier, turn both the audio output and aerial potentiometers full up and search for signals. Depending on your location, either a short piece of wire, or something larger may be required for an aerial.

For the alignment process, no equip-

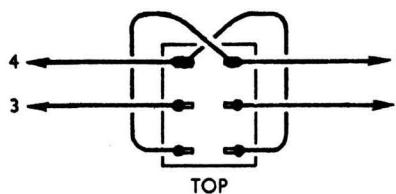
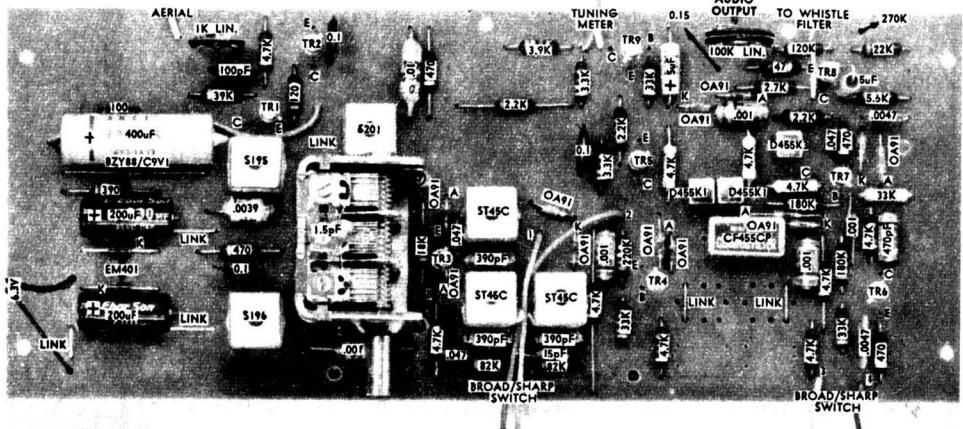
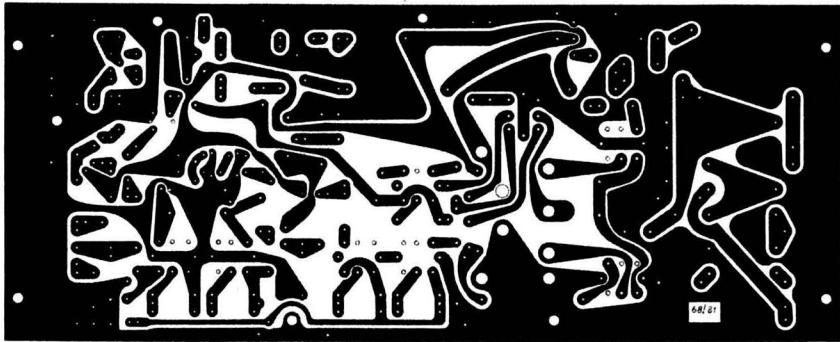
*A coded photograph showing the layout of the completed board before assembly into the case. Above, is a reduced reproduction of the printed wiring board. As shown, it is transposed left to right with respect to the coded photograph. In other words, if the board is transposed end for end, the pattern will correspond with the coded photograph.*

ment except an aligning tool is really needed. The first thing to be done is to lock the dial and the gang together correctly, so that the "law" of one coincides with that of the other. As there is no pointer set line on the dial scale, we had to determine by trial and error where this should be. Close the gang fully, slide the pointer to the right and set it  $1/8$  in to the right of the 550 calibration point. The top end of the pointer is bent over and bent around the cord, so that a positive drive will result. Care must be taken to prevent the top of the pointer from fouling the dial drum.

Set the selectivity switch to the narrow position. Tune in a strong station and, if the tuning meter indicates more than about three-quarters of full scale, turn down the aerial attenuator until this meter reading is obtained. Adjust the single IF transformer for a peak on the tuning meter. Re-tune the dial for a maximum peak on the meter and check the IF transformer again. It may be necessary to do this a number of times, to ensure that the IF transformer is in the optimum position for the three ceramic filters.

Tune a station at about 600KHz and one which is positively identified. Adjust the slug in the oscillator coil until this station tunes on the dial at the correct position. Now tune a station at about 1300 KHz. The trimmer on the oscillator (centre section) of the gang is adjusted until the station tunes to the correct dial setting. Return to the other station and adjust the slug if necessary, to correct for any change. This process must be continued until the stations remain at their correct positions.

Now tune across the dial and check that all stations fall into their correct positions. In our case, the result was not as good as we would have liked



BACK OF SWITCH  
LOOKING ON LUGS

*A wiring diagram for the selectivity switch. The lead numbers refer to similar numbers shown on the coded photograph.*

and we had to accept some compromise in the final adjustment. This error is probably the end result of several minor errors, involving the respective laws of the gang and dial scale, etc. At this point, if there is any serious error which you would like to reduce at least, then this should be done by re-setting the point(s) involved, by re-adjusting the oscillator coil slug and gang trimmer, as previously outlined.

Now we have to align the RF bandpass filter and we suggest that you make the adjustments at the same positions on the dial as previously. As the circuits are overcoupled, special measures must be taken to ensure correct alignment. The technique is to damp one of the coils with a  $10K \frac{1}{2}W$  resistor, with leads as short as possible and then adjust the other coil.

Tune to the station at about 600 KHz and adjust the slug in the undamped coil, for a peak on the tuning meter. Now tune to the station towards the other end and adjust the same coil by the trimmer on the relevant section of the gang. Repeat this process as before, until you are satis-

fied that both ends are correct. Remove the damping resistor and solder it across the coil which has been adjusted and proceed as before. Remove the damping resistor and the job is done. The alternative is to use a sweep generator and CRO, but this is not necessary.

The remaining section to be adjusted, is the pair of back-to-back IF transformers. As these are overcoupled, the same technique is used as before. Tune a station accurately on the meter and with the switch in the NARROW position. DO NOT TOUCH THE DIAL TUNING. Set the switch to the broad position and adjust the undamped coil for maximum peak. Change the damping resistor to the

(Continued on page 157)

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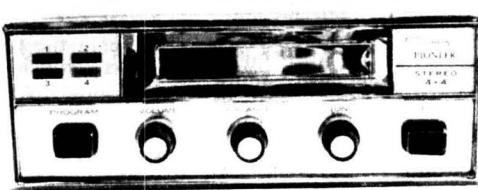
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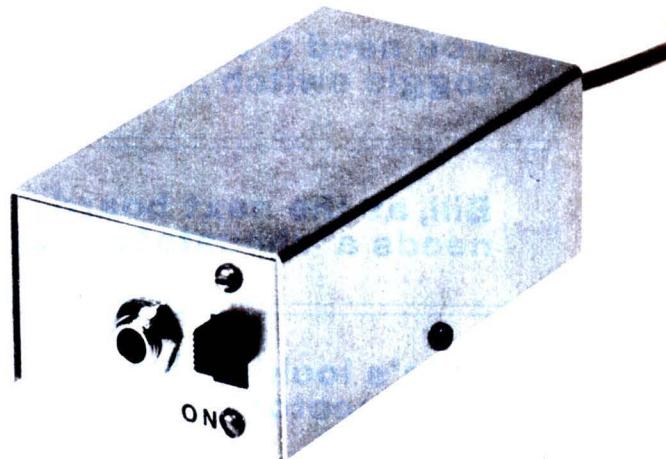
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by Anthony Leo

In fact, the preamplifier came into being because of a situation involving one of our staff members. A young relative had come across an electric guitar which was available cheaply and which he felt he might be able to learn to play.

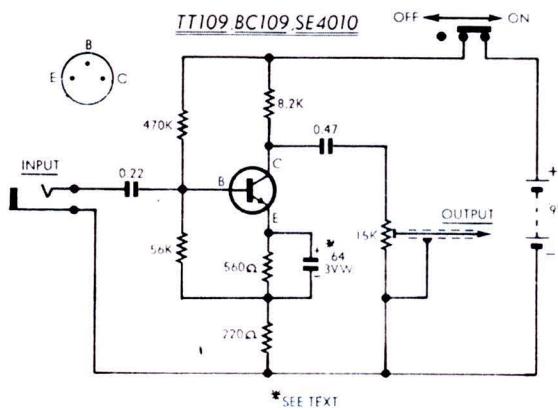
However, being rather short of money, he was quite unwilling to become involved also in the purchase of a guitar amplifier, on the off-chance that he could use it. What he did have on hand was an ordinary record playing amplifier, with ample power for guitar practice, but not enough gain to work from the 20-odd millivolts of signal available from a typical instrument.

Would it not be possible to make up a small preamplifier which would bring the signal from the guitar up to a suitable level to drive the amplifier?

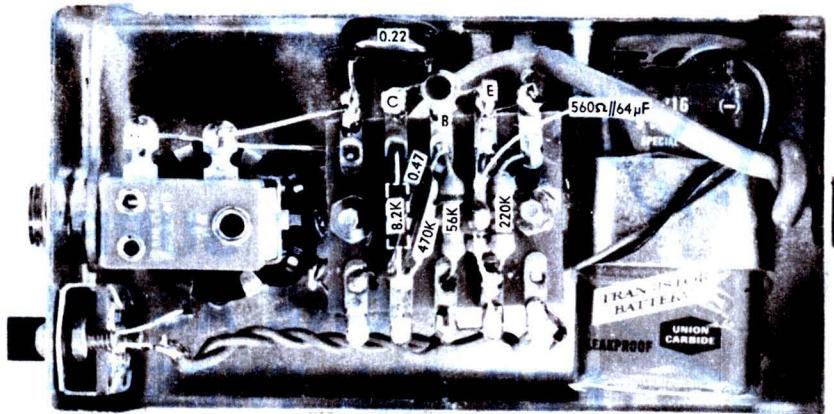
On the assumption that other readers might possibly be faced with a similar dilemma, we decided to build up a preamplifier for the job. The requirements were set down as follows:

- The preamplifier would have to be self-contained and independent of the power mains or the power supply in the basic amplifier. This meant that it would have to be transistorised and work from a small battery, housed inside the case.
- Input impedance would preferably have to be 50K or higher.
- To boost the output from a guitar to the approximate level in a ceramic or crystal pickup channel, the preamplifier would need to have a gain of from 10 to 20 times. It would also have to be capable of accepting the full likely signal from a bass string, without overloading.
- The preamplifier would not need provision for tone compensation, vibrato or fuzz, at least in its present form. Its role would simply be to allow the would-be musician to learn the fundamentals without becoming involved in effects. Ordinary volume and tone control functions would be available from both the guitar and the basic amplifier.

A circuit which meets these requirements and which, at the same time, is simple and inexpensive, is illustrated on this page. It involves a single transistor connected in a common emitter



*Above, the completed guitar pre-amplifier and, at left, the very simple circuit which it employs. The inside of the preamplifier is shown below, nearly full size.*



configuration, with degenerative feedback in the emitter circuit and a "bootstrapped" bias divider to secure increased input impedance. The intrinsic voltage gain is about 18 times, assuming the use of a transistor with fairly high beta (i.e., current gain).

Output could be taken directly from the 0.47uF capacitor coupling to the transistor collector but we have suggested the provision of a tab pot, which allows the gain of the preamplifier to be varied to suit individual requirements. If the input circuit of the basic amplifier is prone to overload, or if the gain of the system overall is high enough to make volume control settings critical, the tab preset pot, can be turned back as necessary.

As presented, the preamplifier operates from a 9-volt supply which, for convenience, can be a small battery with press-fit terminals. The supply voltage largely determines the signal voltage swing at the collector of the

transistor and, in the circuit as shown, the maximum RMS output voltage is a little over 2V. This, in turn, means that the input voltage should not exceed say, 100mV, otherwise appreciable distortion will result.

However, the intrinsic gain of the preamplifier stage may be decreased to six times by simply removing the emitter bypass capacitor, providing relatively distortion-free amplification for signals peaking up to 300mV. It is most unlikely that signals anything like this will be encountered from normal instruments, however. If they were, there would be no need for this preamplifier; such a guitar could feed straight into a pair of pickup terminals!

We built the prototype preamplifier in a small aluminium box measuring  $4 \times 2\frac{1}{4} \times 1\frac{1}{8}$  inches. The components were wired on a small section of miniature resistor panel, while the tab-mounting potentiometer was secured to

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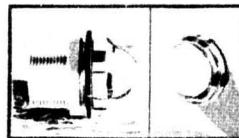
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the bottom of the box, with a hole provided for access to the screwdriver-slot adjustment.

A bracket fashioned from scrap aluminium serves to retain the 9-volt battery, while a small slider type switch serves for the off-on function. The current drain is only about 0.5 milliamp and it will not matter much if anyone using the preamplifier forgets on occasions to switch it off.

Signal input to the preamplifier is via a standard phone socket, which seems to be the most usual connector for electric guitars. Output is via a length of shielded microphone cable; this should logically be terminated in a connector to suit the amplifier with which it is to be used.

In the case of stereo record players, connection to both channels is desirable in order to secure the full available power output. In some cases connection to both channels will be

available via a mono "tape input" socket; in other cases, output from the preamplifier will have to be bridged to both inputs. Naturally, the braid of the cable must go to the earthy side of the amplifier input system.

Tested with typical amplifier systems and a solid body guitar made locally by R. Moody and Co. Pty. Ltd., the preamplifier gave ample output for practice in the home with the guitar and amplifier volume controls about half on. There was no sign of overload with the bottom string plucked hard, and enough gain to exploit novelty effects with the top string.

Needless to say, the young would-be musician was delighted — though we didn't call back to register the reaction of other members of the household. He could practise with his guitar to his heart's content for an additional cutlay of three or four dollars.

a high order of rejection can be achieved by using an extra transistor as an emitter load with constant current characteristics.

For our purpose, however, we have simply used a 10K common emitter resistor in the interests of simplicity and economy. As presented, the pre-amplifier provides 30dB of common mode rejection.

Directly coupled to the second transistor in the differential pair is a PNP common emitter stage providing additional gain, making the total about 220 times. Thus the input sensitivity will be a little more than 1mV for a nominal output of 250mV.

Although differential amplifiers typically have low input impedances (approximately 2K for the present preamplifier) noise output tends to be higher than for a single-ended stage of similar voltage gain. However, the signal to noise ratio of the preamp, including the single ended PNP stage, is quite satisfactory at 48dB.

As an option, we have provided an emitter follower stage for low output impedance. This stage can either be included or omitted depending upon the load requirements. For load impedances of greater than, say, 50K the emitter follower may be omitted, the load simply being coupled to the collector of the PNP transistor via a 0.47uF capacitor.

Otherwise, the direct coupled emitter follower should be retained, providing a low output impedance sufficient to accommodate loads of less than 1K. For lower load impedances a larger coupling capacitor is required to maintain adequate low frequency response.

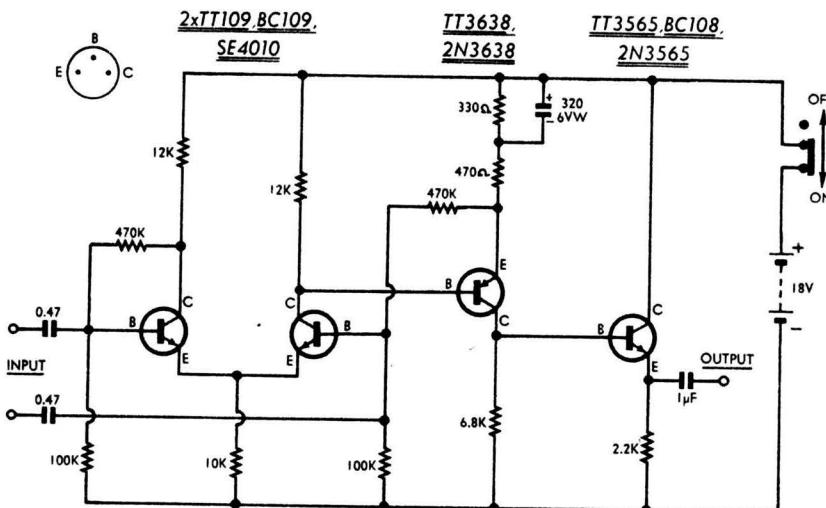
The frequency response of the pre-amplifier is in fact 3dB down at 45 KHz and at the low end, 30Hz. The total current drain of the preamp as presented is 5mA but, without the emitter follower stage, the drain is reduced to about 1.7mA. ■

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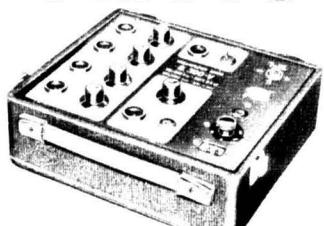
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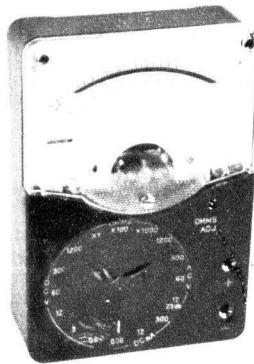
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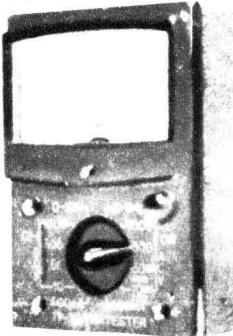
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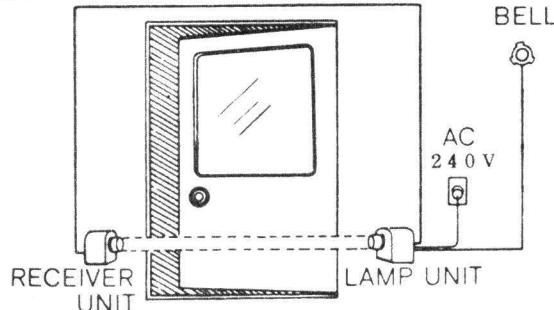
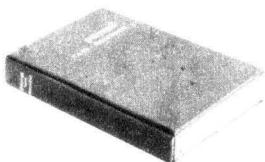


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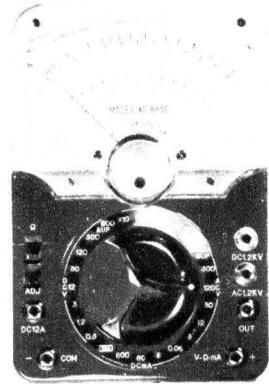
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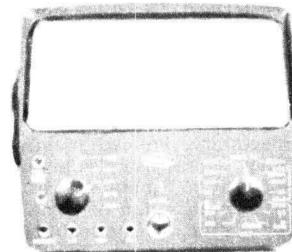
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# Power Supplies For Transistors In Valve Equipment

When transistor circuitry is to be incorporated into equipment originally or predominantly using valves, provision must usually be made for a suitable low-voltage power supply. Described in this brief article are some of the many possible approaches.

by Jamieson Rowe

Possibly the simplest means of obtaining a suitably low supply voltage is a resistive voltage divider connected to the HT line, as shown in figure 1(a). However, in general this approach can only be used where the current drain of the transistor circuitry is quite modest, where the HT power supply circuit of the valve equipment is capable of supplying the additional current involved.

With this circuit the values of the two divider resistors  $R_1$  and  $R_2$  are determined both by the voltage and current requirements of the transistor circuit, and by any further requirements regarding loading regulation, ripple filtering or signal decoupling (note that the line voltage regulation remains fixed and equal to that of the HT voltage supply).

Broadly speaking the ratio of the two resistors determines the output voltage, while their absolute values both directly determine the ripple filtering and decoupling, and inversely determine the loading regulation. Low values give good regulation but poor filtering and decoupling, and vice-versa. It should also be borne in mind that low resistor values give increased loading of the HT line.

From theory the effective output circuit of a simple resistive divider may be represented by a battery whose voltage is a fraction of the HT voltage given by  $R_2/(R_1 + R_2)$ , in series with an AC generator whose output is a similar fraction of any signal or ripple on the HT line, together with a series resistance equal to the value of  $R_1R_2/(R_1 + R_2)$ . The latter component will determine the load regulation of the divider, and also in conjunction with capacitor C the ripple filtering and decoupling.

For typical applications in which the load current is modest and ripple of minor concern, a convenient rule of thumb is to allow resistor  $R_2$  to draw a current equal to that of the transistor circuit load. This permits simple calculation of  $R_2$ , whose value will be given by the load voltage  $V$  divided by the load current. Similarly  $R_1$  may be found by dividing the difference between the HT and transistor load voltages ( $HT - V$ ) by twice the load current.

Capacitor C may be an electrolytic type with a value as large as necessary to satisfy filtering and decoupling requirements, and with a working voltage rating equal to or exceeding  $V$ . The resistors should have dissipation ratings adequate for the job, of course;

the dissipation of  $R_1$  will be given by  $(HT - V) \cdot 2I$ , where  $I$  is the load current.

In cases where the loading regulation, line voltage regulation or filtering performance of a simple resistive voltage divider is inadequate it may be found necessary to employ a zener diode divider circuit as shown in figure 1(b). Here the lower divider resistor is effectively replaced by a zener or "breakdown" regulator diode Z, whose terminal voltage remains substantially constant for a range of current values. As the diode is connected

*Four possible methods of obtaining a few millamps of supply current for transistors from existing circuitry in typical valve equipment (b) would have an advantage in very high gain equipment where "motor-boating" might be a problem due to coupling through the power supply line.*

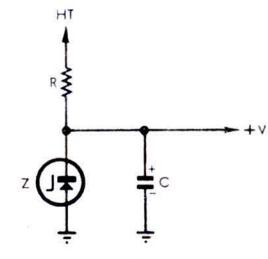
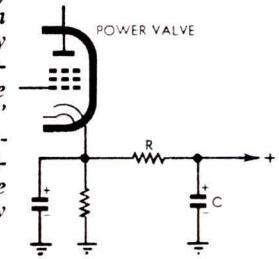
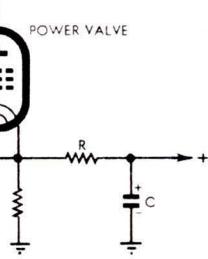
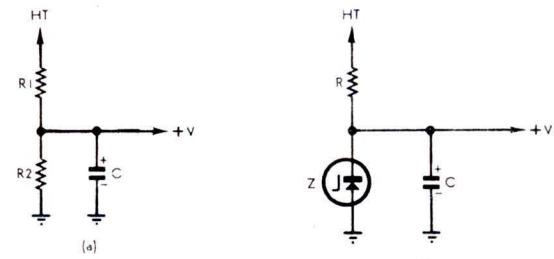


Figure 1

directly across the transistor circuit load, the load voltage may therefore be stabilised.

Naturally enough the zener diode Z is chosen to have a nominal "regulation plateau" voltage equal to the required transistor circuit supply voltage  $V$ . The value of resistor R is then determined, using one of two approaches depending upon the circuit parameters of major interest.

If the current drain of the transistor circuit load is substantially constant, and the main concern is to stabilise its supply voltage despite variations in the main HT voltage, then R should have a value such that Z still remains in the breakdown state when the HT voltage is at its **minimum value**. Typically this will mean that R will have a value equal to  $(HT_{min} - V)$  divided by a current of about 3 or 4 millamps

larger than the load current. Naturally Z will have to be a device capable of dissipating the appropriate maximum power when the HT is at its maximum value.

On the other hand if the HT supply is substantially constant while the load current is subject to variations, then R should have a value such that Z still remains in the breakdown state when the **load current is a maximum**. In the typical case this will give a value for R of  $(HT - V)/I$ , where I is a current about 3 or 4 millamps larger than the maximum load current. As before, the zener will have to have a dissipation rating adequate for the maximum dissipation condition, which will in this case be when the load current is a minimum.

The loading regulation of a zener diode divider will tend to be significantly better than that of a simple resistive divider, due to the stabilising action of the zener diode. The latter also gives a significant measure of line voltage regulation, together

with intrinsic ripple filtering and signal decoupling.

As a result of the ripple filtering and decoupling action of the zener diode itself, capacitor C may not be required in less critical applications; however, when used it will give improved performance. Note that in contrast with similar regulator circuits employing gaseous discharge tubes, there is in general no tendency for a circuit of this type to produce relaxation oscillations.

In some types of valve equipment, provision of simple or zener HT voltage dividers may be rendered unnecessary as a result of the availability of low voltages at power valve cathodes. Where only moderate currents are required, such points can provide a convenient and quite satisfactory source of low voltage supply, as illus-

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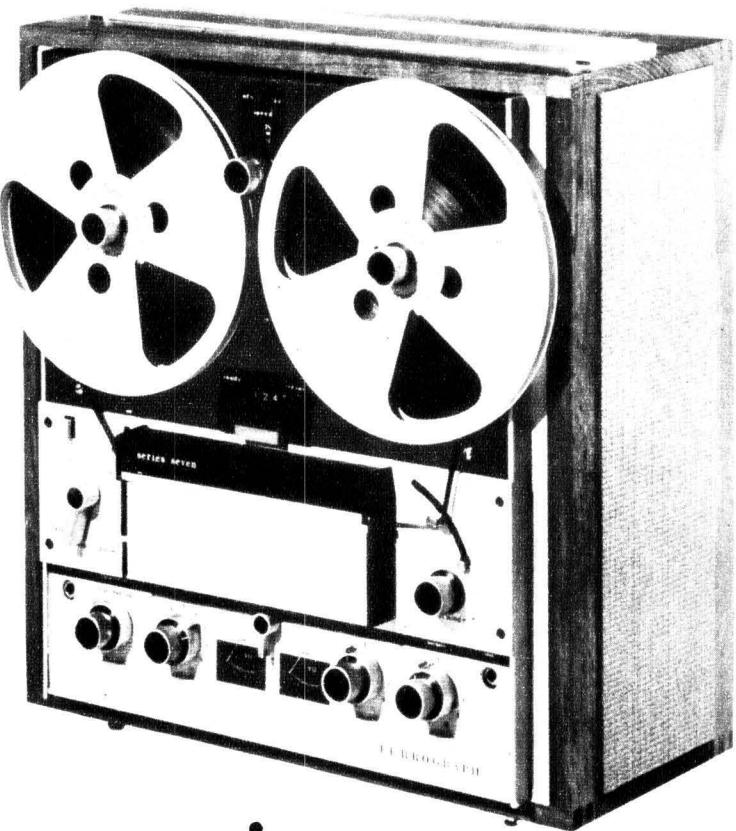
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trated in figure 1(c). In most cases the voltage available at a power valve cathode is well regulated and filtered, due both to the low impedance of the cathode components and to the high effective impedance of the valve itself.

When the current required by the transistor circuit load is slight compared with the power valve cathode current, this type of supply need typically consist of nothing more than a simple R-C filtering and decoupling circuit, as shown. The value of the resistor  $R$  will be dictated largely by the allowable voltage drop, which will depend in turn upon the available cathode voltage and the required transistor supply voltage. Once the value of  $R$  has been fixed, the value of capacitor  $C$  may then be determined on the basis of adequate decoupling and ripple filtering.

valve bias for the current required. A bypass capacitor at the grid also provides a significant measure of ripple filtering and signal decoupling, as a result of the familiar cathode-follower action.

Naturally enough the valve selected for use in such a circuit will need to be capable of tolerating the power dissipation involved, which will be equal to  $(HT \cdot V)$ ,  $I$  where  $I$  is the load current. Apart from this requirement, the valve should also have a fairly high transconductance and low plate resistance if the transistor supply is to be well regulated and filtered.

Any of the four power supply approaches thus far described will in general only be suitable where the HT supply of the existing equipment has sufficient capacity to supply additional current. In equipment where this is

for very low current applications, or where ripple and poor regulation are of little consequence. The peak DC output voltage developed across the reservoir capacitor  $C$  is approximately 9V, so that any R-C filtering used will provide a load voltage of less than this figure.

The addition of a further diode and "bootstrap" reservoir capacitor to the simple half-wave circuit produces the half-wave doubler circuit of figure 2(b). Here the peak output voltage generated across the output reservoir capacitor is approximately double the previous value, or roughly 18V. Hence although the regulation and ripple characteristics of this circuit tend to be rather similar to the previous circuit, the higher initial output voltage typically allows the use of more extensive R-C filtering.

It may be noted that the circuits of figure 2(a) and (b) both incorporate a fixed resistor in series with the connection to the heater winding. The purpose of this resistor is to limit the amplitude of the switch-on current surge through the diode(s), which surge occurs when power is first applied to the uncharged reservoir capacitors.

Calculation of the resistor value is based upon knowledge of the surge current rating of the diode(s) in use. As the effective AC supply resistance of the transformer heater winding will in general be negligibly low, a con-

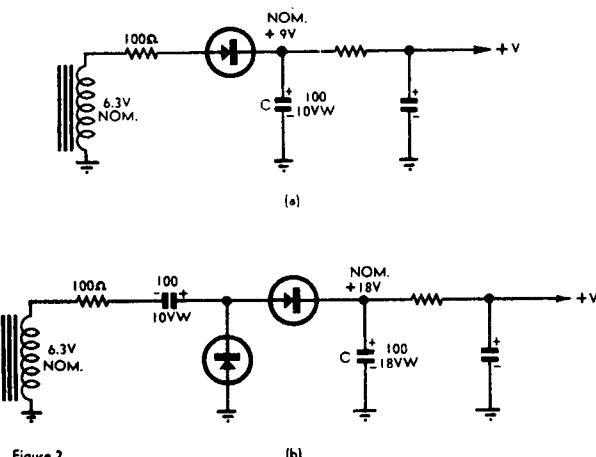


Figure 2

If the current drain of the transistor circuit load will represent a significant proportion of the existing cathode current, it will generally be necessary to replace the existing cathode resistor with one of higher value, to maintain the same effective resistance between cathode and earth. If this were not done, the valve operating point would tend to change, possibly upsetting its operation.

The value of the new cathode resistor can easily be found using Ohm's law, as the new value will simply be that which develops the original cathode voltage when the available current is diminished by an amount equal to the transistor circuit load current.

In the limiting case, where the transistor circuit current is sufficient to equal the original cathode current, the cathode resistor will no longer be required; however, it should be realised that the latter situation may involve problems if the drain of the transistor circuitry tends to vary appreciably. In such cases it may be necessary to employ a zener diode in place of the cathode resistor, to maintain a constant cathode voltage.

Equipment in which no suitable power valve stages are available for the foregoing approach may alternatively permit the addition of a simple valve "series regulator" circuit of the type shown in figure 1(d). Here the valve is effectively operated as a cathode-follower stage, a resistive voltage divider pegging the grid at a potential greater than the required transistor supply voltage by an amount which will provide the appropriate

Simple half-wave circuits for heater wiring which is earthed by one side. Output can be positive or negative as desired.

These full-wave circuits for centre-tapped 6.3V windings would have a special appeal if used in conjunction with a small, centre-tapped 12V transformer.

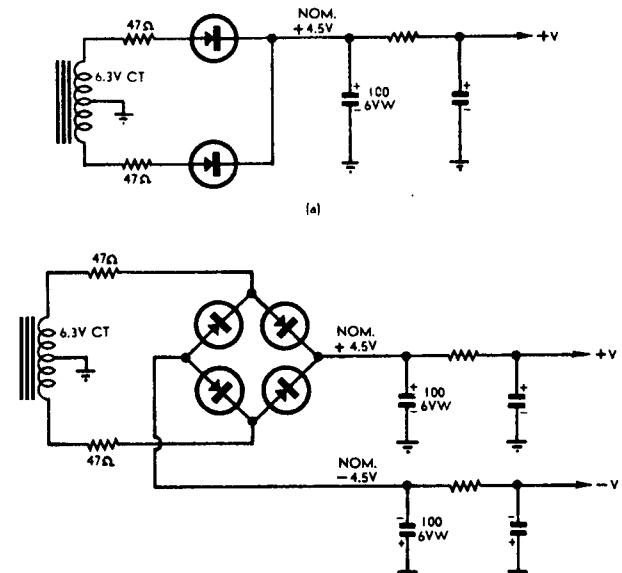


Figure 3

not the case, it may be necessary to derive the supply for the transistor circuitry from the AC heater line, using a circuit perhaps similar to those illustrated in the remaining diagrams.

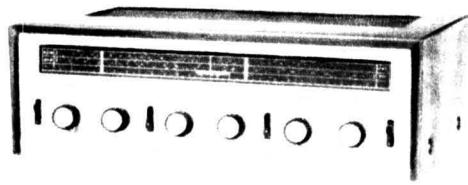
In figure 2(a) and (b) are shown rectifier circuits suitable for equipment having a 6.3V heater line in which one side of the line is earthed. The circuit of (a) is for a simple half-wave supply, while that of (b) is for a half-wave voltage doubler supply. Although both are shown as arranged for earthing of the output negative polarity, either may be adapted to produce an output of opposite polarity simply by reversing the connections of the diodes and electrolytic capacitors.

The simple half-wave circuit of figure 2(a) tends to have high 50Hz ripple, together with rather poor regulation. This makes it suitable mainly

for very low current applications, or where ripple and poor regulation are of little consequence. The peak DC output voltage developed across the reservoir capacitor  $C$  is approximately 9V, so that any R-C filtering used will provide a load voltage of less than this figure.

The addition of a further diode and "bootstrap" reservoir capacitor to the simple half-wave circuit produces the half-wave doubler circuit of figure 2(b). Here the peak output voltage generated across the output reservoir capacitor is approximately double the previous value, or roughly 18V. Hence although the regulation and ripple characteristics of this circuit tend to be rather similar to the previous circuit, the higher initial output voltage typically allows the use of more extensive R-C filtering.

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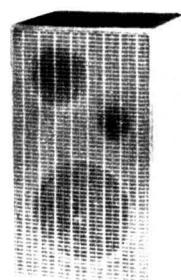
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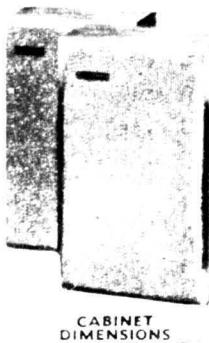
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Although there may be a natural temptation to give the surge limiting resistor a value larger than that sufficient to limit the surge current within the diode ratings, this is not necessary. In fact it will generally be undesirable, because increasing the resistor will degrade the potential loading regulation of the supply.

*Novel arrangements which give a peak or unloaded DC output approximately equal to 1.5 times the peak value of the AC supply circuit. They would be suitable for situations where voltage and hum level were not critical factors.*

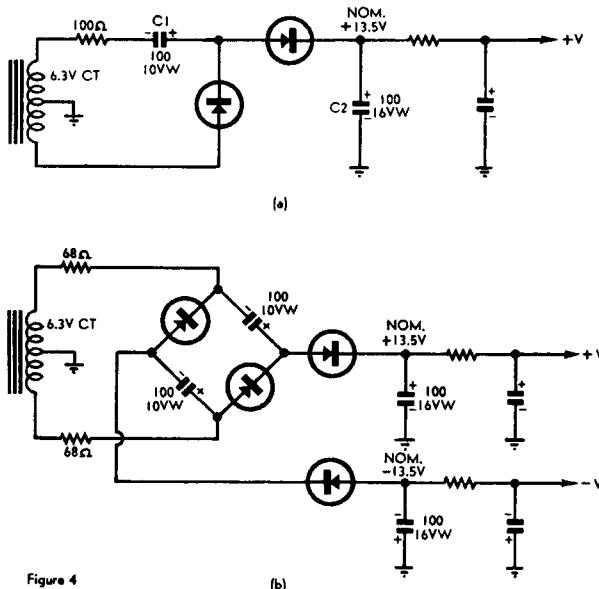


Figure 4

Fairly obviously the circuits shown in figure 2(a) and (b) will be of limited use in equipment where the 6.3V heater line has an earthed centre-tap, because in this case they will provide peak output voltages of only 4.5V and 9V respectively. In such equipment it will therefore generally be necessary to employ other rectifier circuits, possibly those illustrated in figure 3.

In figure 3(a) is shown a full-wave circuit. While this will only provide a peak voltage output of 4.5V across the reservoir capacitor, the full-wave action results in somewhat improved regulation and reduced ripple amplitude (also twice the frequency, at 100Hz) compared with the half-wave circuit. Hence it is often quite feasible to employ such a circuit to deliver well-filtered 3V DC to a preamp or similar circuit, whereas this is usually not possible with the half-wave circuit.

Although the circuit configuration shown produces a DC output having the negative polarity at earth potential, the alternative positive-earth arrangement can be provided as before simply by reversing the polarity of the diodes and capacitor(s).

In fact there is no reason why positive-earth and negative-earth full-wave circuits cannot be connected to the same heater winding, and this is shown in figure 3(b). From the diagram it may be seen that the circuit then becomes virtually a "full-wave bridge," in which the DC output is inherently centre-tapped with respect to earth. The resultant +4.5V and -4.5V supplies may typically be used for preamplifiers, logic gates and other control circuitry.

As before the circuits are fitted with surge limiting resistors, in this case having a value of 47 ohms to permit a maximum diode surge current of 90mA. Lower values may of course be used with diodes having higher surge ratings.

There will no doubt be cases where higher DC supply voltages than are provided by the circuits of figure 3(a) and (b) must be derived from a centre-tapped 6.3V heater line. In such cases the circuits shown in figure 4 may prove useful, particularly where only

The actual current levels at which each voltage will have fallen by a particular proportion will depend largely upon the size of the reservoir capacitors, and also to a lesser extent upon the value of the surge limiting resistor(s) and the regulation of the transformer heater winding. Hence to obtain as close to the peak output as possible from each circuit, it will be necessary to use the largest feasible values for the reservoir capacitor(s), and to use no larger value for the surge limiting resistor(s) than is strictly necessary. ■

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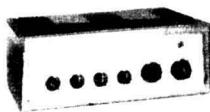
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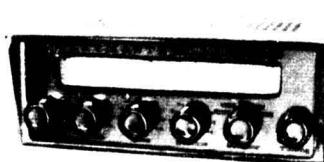
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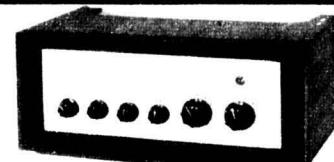
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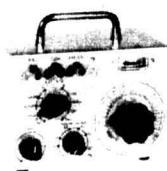
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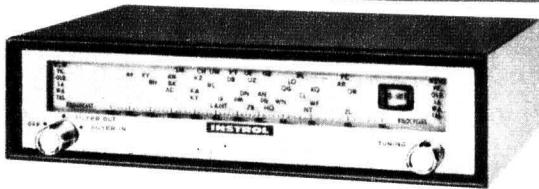
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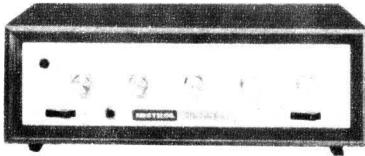


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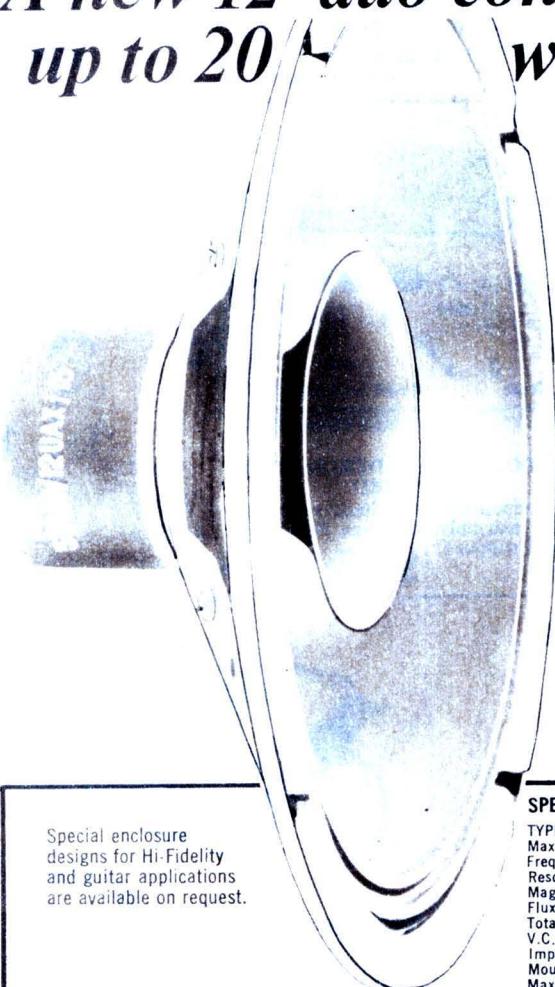
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Frequency Range	45-12000 Hz	45-6000 Hz	45-6000 Hz
Resonance	50 Hz	50 Hz	50 Hz
Magnet Material	Alnico V	Alnico V	Alnico V
Flux Density	13,000 gauss	13,000 gauss	13,000 gauss
Total Flux	100,000 lines	100,000 lines	100,000 lines
V.C. Diameter	1 1/2"	1 1/2"	1 1/2"
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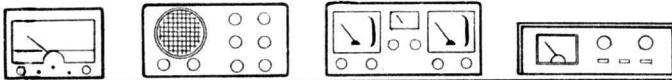
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# The Serviceman



## COLD WAR ON INTERMITTENTS

The intermittent fault, like the poor, seems destined to be always with us. Transistors may replace valves, printed boards discrete wiring, and integrated circuits discrete components, but the "intermittent" simply moves from the old to the new and pops up as regularly as ever — or so it seems to those of us who have to track them down.

This being so, any technique aimed at minimising the time taken to find them is well worth considering, even where it is applicable only in certain cases. In fact, there is no single technique for tackling this kind of fault. Each case needs to be treated on its merits, and the most successful technicians are those who have the greatest range of techniques available.

Much depends on the type of stimulus which seems to initiate the fault. Thus, some sets are extremely sensitive to minor voltage surges, such as caused by switching lights or appliances on or off. Others are temperature sensitive, and follow a fairly predictable pattern. Others, again, don't seem to follow any set pattern, and can be real "stinkers."

Techniques include mass monitoring of voltages (or currents) with regular on-off cycling to encourage failure, signal tracing, heat cycling, mass replacement of suspect components (such as certain brands of capacitors) and even, in one case which I reported recently (February 1967) nomination of a switch contact by carefully studying the symptoms and relating them to the circuit diagram. Unfortunately, it is not often that one can pull a stunt like this last one.

It is a help to realise that most intermittents are temperature-conscious, even if this is not immediately evident from the broad symptoms. Basically, the intermittent fault is due to a faulty connection. It may be a dry soldered joint, a poor junction between a capacitor pigtail and the foil, a fractured weld in a valve assembly, a hair-line crack in a printed wiring pattern, or any one of almost unlimited variations on this theme. But, regardless of the precise nature, the size and shape of the materials involved must inevitably change with changes in temperature. And, even where temperature may not appear to be the stimulus involved, extreme changes in temperature may often expedite the appearance of symptoms and make possible some form of planned attack.

This approach has been known, and used, for a long time. Sometimes it amounts to nothing more than "smothering" the set with some form of insulating blanket so that its own heat

is enough to raise the temperature well above normal. Alternatively, this may be necessary in order to simulate the cabinet, since some faults will show up only when the set is in the cabinet. A rather more refined approach is that of deliberately directing heat onto the chassis from a radiator or infra-red drying lamp.

However, a couple of recent experiences gave me a practical introduction to an interesting variation on this technique; that of severely lowering the temperature of selected groups of components, or even individual components, when the heating technique is either ineffective or inconclusive. This technique has been made possible by the availability of pressure cans of liquid refrigerant, marketed specifically for this purpose. When sprayed onto a component for a few seconds it will reduce the temperature very rapidly. In fact, there is no difficulty in producing a layer of frost on the component!

I had been vaguely aware of this technique for some time, but had never reached the point of doing anything about it, other than to make equally vague resolutions to investigate it more



The pressure can of refrigerant discussed in the text. Note the long angled application tube.

fully when I had a chance. As it turned out, circumstances created the chance for me, and I was happy to take advantage of it.

One of my colleagues is by way of being a rather specialised serviceman. He works for an organisation which imports and markets closed-circuit TV systems, as used for educational and instructional purposes. As can be imagined, fault-finding in this kind of equipment has its own peculiar problems, by reason of its unusual nature and its complexity. And, when something goes intermittent, the large number of components makes it a really serious problem. This, then, is the background against which my colleague told his story.

The equipment concerned was an old (by solid-state standards) valve type TV camera and associated control unit. The control unit housed the basic time-base generator and divider networks supplying the line and frame time-base circuits, plus a small monitor tube.

The time-base signals were derived from a master oscillator working at twice the line frequency (31,250Hz) which was divided by two for the line signals, then by means of several multivibrator divider stages, to the frame rate (50Hz). The system was designed to be locked to the 50Hz mains and for this purpose was fitted with an AFC circuit. The nominal 50Hz derived from the master oscillator was compared with the mains frequency, an error signal created as a result of any difference, and this signal applied to the 31,250Hz oscillator to bring it into step with the mains. The presence of this feedback loop has an important bearing on the story.

The fault was a particularly annoying temperature-conscious condition. After about an hour or so of operation the picture on the monitor, and any other screens which happened to be connected to the system, would begin to expand and contract at about a one-second pulse rate. Confirmation that it was a temperature conscious condition was provided when the first attempt was made to track it down. The simple act of opening the side of the control unit case was sufficient to cure the fault, due to the loss of heat. This, in itself, did not make the job any easier.

This difficulty was overcome by employing an infra-red heat lamp to raise the temperature of the equipment while the side of the case was open. This wasn't a particularly convenient arrangement, but at least it did allow the fault to be created, more or less at will, while a particular section was being monitored.

Working in this way, my colleague and an assistant eventually established that the frequency of the master oscillator was varying at the pulse frequency and concluded that this, in turn, was upsetting the deflection circuits of the vidicon tube, causing the deflection sweep to vary at the pulse rate. This explained why the effect was present on both the monitor tube and any external receivers connected to it.

It was further established that the fault was actually a "hunting" action within the aforementioned AFC circuit; the only snag was to determine where. In any feedback circuit—even the relatively simple feedback system

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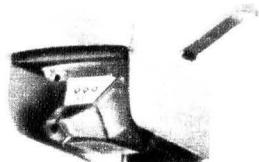
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in an audio amplifier—it can be extremely difficult, if not impossible, to nominate a particular stage which is upsetting the chain. This is because the fault, as it may be observed on a CRO for example, tends to appear in every stage, due to the feedback action.

Thus it was that all their attempts to nominate the faulty stage, using a double-beam CRO to compare input and output of each divider network in turn, proved fruitless. Similarly, such obvious approaches as changing the master oscillator and divider chain valves, monitoring voltages, etc., led nowhere. They were facing the possibility that any component within the divider chain or feedback network could be the culprit and that every one of them might have to be changed in order to locate it; a task of impractical magnitude, considering the number involved.

It was at this point that my colleague decided to try localised heating and cooling. As a first step he rearranged the heat lamp so that its heating action was rather more localised than previously, then proceeded to heat various sections of equipment while noting how long it took for the fault to appear. By this means he was able to establish that the section involving the master oscillator and the first divider chain alongside it seemed to be far more sensitive than any others.

Leaving the heat lamp in operation so that the fault remained in evidence, he then armed himself with his can of freezer, systematically squirted each component in turn, and noted the effect. For a while nothing happened. Then, as he squirted a mica capacitor in the master oscillator, the fault suddenly vanished. He let the whole thing heat up until the fault reappeared, then tried again. The cure was almost immediate. After a third try he decided it was worth trying a new capacitor. And that clinched matters by completely curing the trouble.

To prove this latter point to his own satisfaction, he allowed the unit to run for several hours, not only with the case closed to keep the heat in, but also covered with a length of old carpet, thus creating a far more extreme condition than would ever be likely, to occur in practice.

When he related this story to me, my colleague was bursting with enthusiasm over the usefulness of the little freezer can. While this was not the only time he had used it, it was by far the most difficult fault he had used it on and, for this reason, the most successful as far as he was concerned. I must confess that some of his enthusiasm rubbed off onto me, and I didn't need any urging to go out and buy a can for myself. Then I found myself wishing that I had a tricky intermittent on which to try it.

Which is really getting enthusiastic!

As it turned out, it was several weeks before I had a chance to try it, and by that time my enthusiasm had waned somewhat. After all, intermittents are still nasty things, not to be lightly wished on anyone, least of all on oneself.

In the meantime, I studied the can and the literature that came with it. The can holds six ounces of liquid and, judging from my own experience with it, I imagine it would provide several hundred average size "squirts." It is



*A detailed examination reveals only 624 lines on my screen—what do you propose to do about it?*

fitted with a fine extension tube, about six inches long, to facilitate the refrigeration in the right place. This is further facilitated by being able to rotate the angled extension tube, relative to the can, to cope with particularly awkward situations.

The makers of this particular product claim that they have added a lubricant to the refrigerant, one effect of which is to provide a protective coating over components which might otherwise be adversely affected by moisture formed as frost. They also claim that the temperature of a component can be reduced to at least  $-50^{\circ}\text{C}$ , if one wishes to go this far. In practice a squirt of a couple of seconds on the bulb of a thermometer will send the mercury tumbling to well below freezing point.

Note that it can also create frostbite if applied indiscriminately to the skin. It should not be handled carelessly, or used as a basis for practical jokes!

The can costs about \$1.60, which works out at only a few cents per squirt. Nevertheless, I imagine there would be plenty of cases where one would gladly use a whole can if it resulted in tracking down a nasty fault.

Finally, I must emphasise that I have no interest in the particular brand shown; it was simply the first one I was introduced to. There may be other makes on the market, and they may do just as good a job, in which case I wish them luck.

When an opportunity to use it finally presented itself, it was in the form of a tape recorder, with the complaint that it would neither play nor record until it had been switched on for about 10 or 15 minutes. Well, at least this seemed to be the type of fault I needed.

The recorder was not one with which I was familiar, but the owner did at least have a copy of the circuit and some general service data, so the job seemed like a reasonable proposition. A rough check on the bench confirmed the customer's description, which was important because the failure in both modes narrowed down the likely sections considerably. For example, it ruled out the bias oscillator, since a failure here would not have involved the playback function. Similarly, reference to the circuit showed that the power output stage was not involved in the recording function, so that put that in the clear. In fact,

there were only three transistor stages which were common to both functions, so it had to be in one of these.

That much established, I opened the case, studied the printed wiring board, and eventually identified the three common stages. Then I switched it on and tried it again. It functioned immediately, suggesting that, if it really was a temperature-sensitive fault, it did not need much rise in temperature to keep it under control. At this point I made a rough check for obvious faults, flexing the board, prodding components, and so on. The result was negative.

At this point it seemed that I was in an ideal position to try the low-temperature technique. The system was working, presumably because it had warmed up sufficiently, so it should be possible to create a failure by lowering the temperature of the faulty component. And, if I could be sufficiently selective in cooling individual components, I should know which one it was.

I started with the first of the common stages and sprayed each component in turn. The result was negative, except that I realised just how difficult it was to spray only one component when half a dozen were grouped together in a bunch. In spite of the very fine tube attached to the can, it was almost impossible to select one component and avoid spraying the rest. All I could hope for was that the faulty component was out on its own.

I moved on to the second stage and tried again. This time I struck oil. Immediately I tried to spray a particular component in a closely spaced group the recorder cut out. Well, at least I had established that the fault was temperature-sensitive, and the group of components involved. Even if the technique took me no further, it had achieved a lot in a short space of time, and without my so much as lifting a soldering iron.

Nevertheless, I determined to try to narrow the field still further, if at all possible. Working on the assumption that the transistor would be the least likely component to develop such a fault I concentrated on the associated resistors and capacitors. I was still faced with the problem of trying to concentrate on one component at a time but, more or less by accident, I hit on a technique which seems to work particularly well.

First I discovered that, by carefully controlling the amount of spray and the distance of the nozzle from the components, I could consistently create the situation where the system would cut out for about half a minute to one minute, then warm up sufficiently to start functioning again. This much established, it occurred to me that I might be able to identify the faulty component by a reverse procedure; heating each component after mass cooling, and note which one restored the performance most rapidly.

For a heating device, I used nothing more elaborate than my finger.

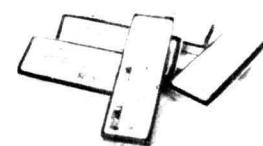
After cooling the group of components I simply placed my finger on each one in turn, and awaited results. Apart from a couple of false alarms, caused by the coincidence of natural warming up and my selection of a particular component, this didn't seem

*(Continued on page 157)*



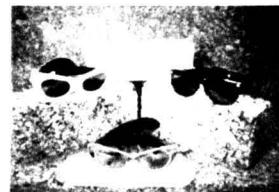
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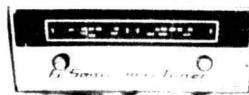
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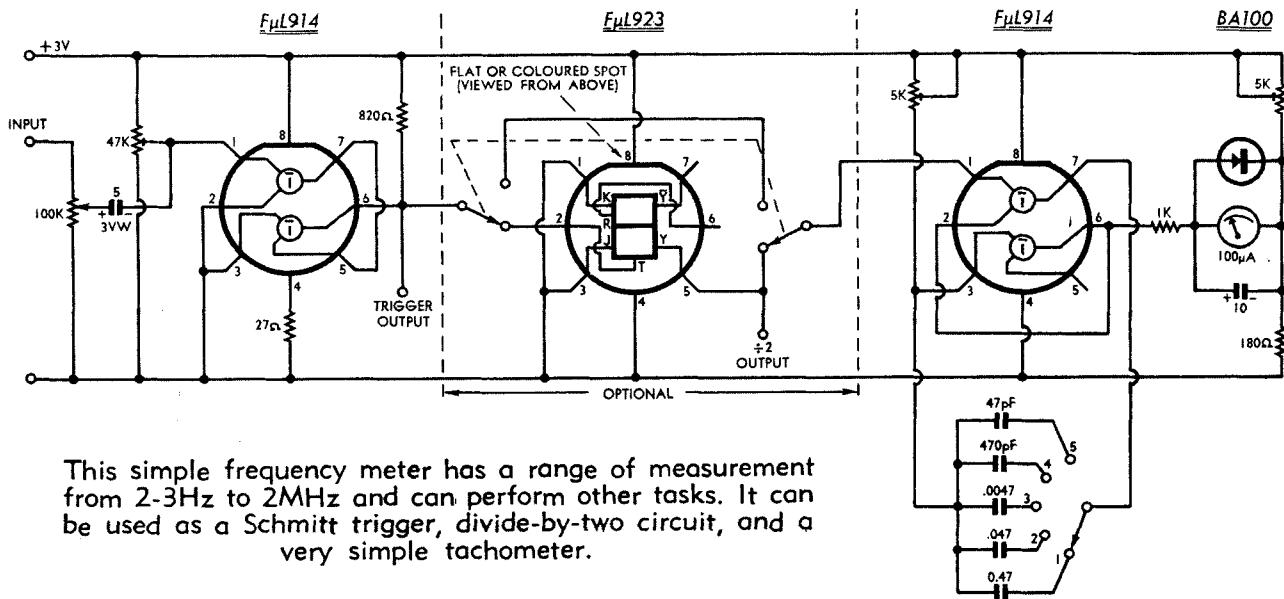
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# A READER BUILT IT!

*Circuits and devices which we have not actually tested in our laboratory but published for the general interest of beginners and experimenters.*

## FREQUENCY METER, TRIGGER, DIVIDER, TACHOMETER



This simple frequency meter has a range of measurement from 2-3Hz to 2MHz and can perform other tasks. It can be used as a Schmitt trigger, divide-by-two circuit, and a very simple tachometer.

**DESCRIPTION:** The circuit uses three inexpensive integrated circuits, two type FuL914 and one FuL923. The first 914 acts as a Schmitt trigger. The input is held just above the triggering voltage by the 47K tab pot and is coupled to the input by a 5μF capacitor and a 100K linear potentiometer, which acts as a sensitivity control. Using this method, less than 150mV (typically 110mV) is required to trigger the Schmitt trigger.

Although not necessary, the second stage, an FuL923, provides frequency division and extends the range of the instrument from 1 to 2MHz. It also makes reading more convenient and accurate in some parts of the scale, e.g. 10-30 ranges. This facility can be switched in or out as shown. If desired, this section may be left out by breaking the circuit at the dashed lines drawn and connecting the output of the Schmitt trigger into the input of the second FuL914.

This is connected as a monostable. It has five "on" times selected by selecting various capacitor sizes as shown. The 5K tab pot allows fine control of the "on" time.

Pulses produced by the monostable are fed via a 1K resistor to a meter, bridged by a 10μF capacitor and a silicon diode. These pulses charge the capacitor which discharges through the meter. Since the RC time constant of the meter-capacitor is fixed, the voltage will depend on the pulse rate (pulse height and width are constant)

and thus on the frequency. Should an excessive pulse rate (and hence voltage) appear at the meter, the BA100 will conduct and shunt the meter protecting it from damage. Meter zeroing is accomplished by the 5K tab pot and the 180-ohm resistor.

**CONSTRUCTION:** The unit was constructed on 4in x 3in printed circuit board. The components were assembled, the board was drilled and the copper laminate cut to provide insulation where required, and the components were soldered in. A 7in x 4in x 3in box was used for the case and a pair of dry cells were used for the power supply. These should be the large torch type as "penlight" cells do not give sufficient life with the current drawn, about 20 to 35mA.

**CALIBRATION:** The instrument requires careful setting up. First, using an AC input and monitoring the Schmitt trigger at the output (end of the 820-ohm resistor) with a ORO, set the 47K resistor to give equal

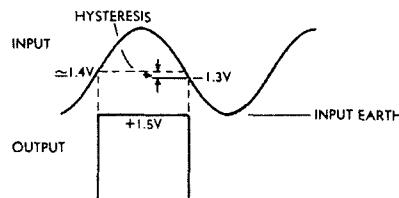
mark/space ratio in the square wave resulting from the sine wave input.

An alternative method is to monitor the DC voltage from negative to the 820-ohm resistor with a multimeter and observe the setting when the meter indication changes (from about 0.2 volts to about 1.5 volts). Move the tab pot back very slightly. Moving back too far will result in the trigger reverting to its original state. Careful setting can get the trigger to sit exactly in the centre of its hysteresis point. (See diagram.) This process ensures maximum sensitivity.

Having set up the Schmitt trigger, it is necessary to calibrate the monostable section. Firstly, set the meter zero using the 5K tab pot in the voltage divider. This backs off the voltage due to the saturated transistor in the output of the monostable. Now, using a 50-ohm mains source, preferably a 6.3V filament transformer, and with the 100K set on minimum and with the unit on the 100Hz range, increase the sensitivity until the meter reads positively.

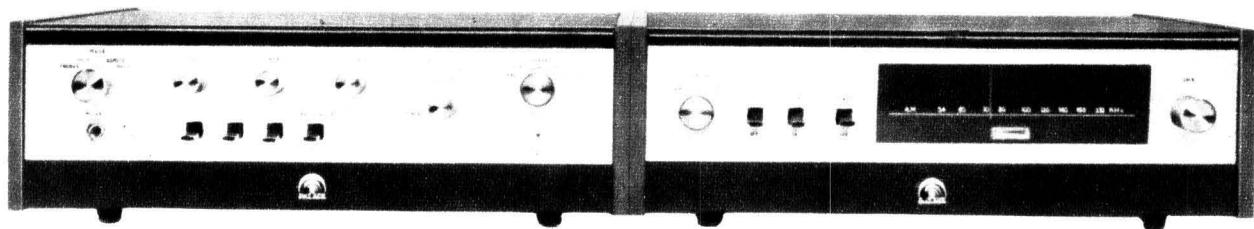
Adjust the 5K tab pot fine timing control until the meter indicates 50. Note that the meter zero moves with this adjustment. Re-set the meter to zero, and recalibrate to 50. Repeat this successive approximation until the meter indicates 50 with signal and zero with no signal.

If an accurate signal generator is available, it will be possible to check the other ranges. The accuracy of the instrument depends on the linearity of



Setting up the Schmitt trigger against an AC input waveform.

# DELUXE ALL-SILICON SOLID-STATE STEREO EQUIPMENT BY PALACE FOR DISCERNING MUSIC LOVERS —POWER—CLARITY—TRUE-TO-LIFE SOUND

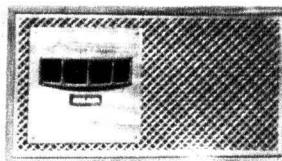


## PALACE SOLID-STATE STEREO AMPLIFIER Model AM-333

Output Power: 60 Watts IHF (30 Watts RMS) into 8 ohms 72 Watts IHF into 4 ohms  
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 Input Levels: Phone (Magnetic) 2 mV Phono (Ceremic) 70 mV Aux 200 mV  
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 Controls: All standard controls including speaker selection switch  
 FEATURES: IC hybrid circuits in preamplifiers, extremely wide frequency response range, high damping factor for dynamic presence, remarkably distortion-free

## PALACE SOLID-STATE AM/FM/MULTIPLEX TUNER Model RA-333

Frequency Range: FM88 to 108 MC AM535 to 1605 KC  
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 Stereo Separation: 25 dB  
 AM Input Sensitivity: 400 Microvolts for 20 dB S/N ratio  
 Image Ratio: 40 dB  
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 FEATURES: Stable Hi-Fi reception without frequency drift, tuning meter, speaker switch for extra speakers, high reliability due to print-board circuitry, extremely low harmonic distortion



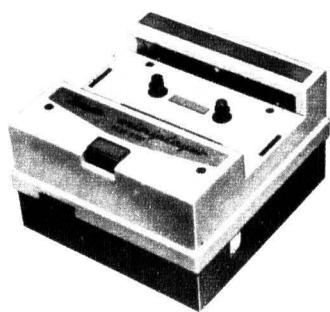
## Model S-776

Frequency Range: 50 to 21,000 Hz  
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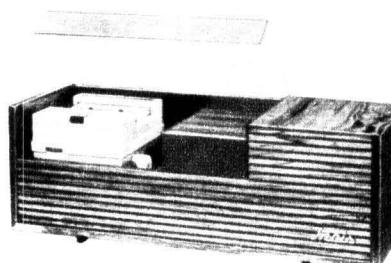
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the meter used and on the accuracy of the timing capacitors. Using ordinary capacitors, the accuracy will be  $\pm 10$  per cent or so. Any range can be calibrated using the above procedure and a signal generator. However, the other ranges may then be wrong.

This problem can be overcome by using expensive precision capacitors, by the use of a calibration table (the method which I chose), or by having a second bank on the switch to select from five 2K tab pots in place of the 1K fixed resistor (each being calibrated individually.) As can be seen from the graph, the linearity within a particular range is controlled by the linearity of the meter, and is typically between  $\pm 1$  and 2 per cent. However, between ranges it is only  $\pm 10$  to 15 per cent. This large error can be eliminated by any of the methods mentioned above.

**USE.** It is advisable to leave the sensitivity on minimum to reduce the possibility of damage to the input of the trigger by excessive voltage. The meter is protected so overloading will not damage it, but this should be avoided where possible.

Switch the instrument on and set the range switch to the range to be measured. These are:

1	100Hz FSD
2	1KHz FSD
3	10KHz FSD
4	100KHz FSD
5	1MHz FSD

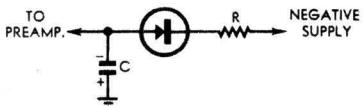
Now increase the sensitivity until

## HEAD MAGNETISATION

Here is an idea which might be of value to readers who have problems with tape-recorder heads becoming magnetised.

In some tape recorders with transistor preamplifiers, magnetisation occurs because pulses of current pass through the blocking capacitors which isolate the playback head from the base bias network. In such cases, one can reduce the magnetisation effect to almost negligible proportions by putting a low-pass filter in the power supply circuit.

When the supply is switched on, C charges at a rate determined by the



values of C and R. (T equals R.C., in secs, megohms and  $\mu$ F). The value of R depends on the supply voltage. If the supply is 10 volts more than strictly required and the preamp draws 1mA, R could be 10,000 ohms. With a capacitance of say 200 $\mu$ F, the charge time would be around the 2-second mark and the current through any likely value of blocking capacitor would be very small.

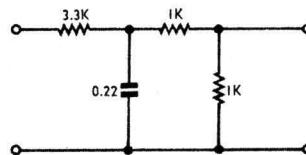
The diode stops C from discharging through the power supply when it is turned off. Polarities would have to be reversed for a positive supply rail. The circuit, incidentally, doubles as a very good decoupling network.

(From L. G. Wright, Elec. Engineering Dept., University of Canterbury, Christchurch 1, N.Z.)

the meter reads and then advance it just sufficiently to get a reliable reading. Using minimum sensitivity ensures loading the source by a minimum amount—this can be most important in tuned circuits, etc.

**Using the Schmitt trigger.** Only AC facilities are included. However, having an input on the 47K pot or on the

stroke must be used to give the necessary pulses/sec to rpm conversion. The triggering spikes can be used to advantage as it should be possible to use only the 914 monostable and one timing capacitor. This would give a very inexpensive tachometer, especially if a zener-controlled power supply were used.



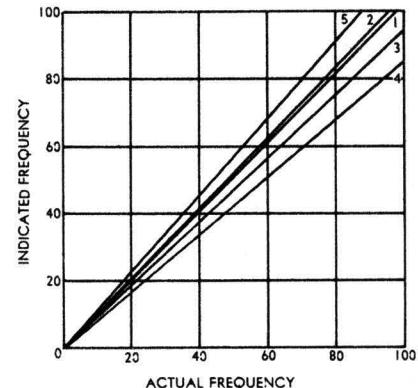
Use a circuit similar to this to minimise voltage spikes, when using the instrument as a tachometer.

trigger input will allow DC use. The output can be taken off either before or after the divide-by-two FuL923.

**Using the divide-by-two range.** Place the input into the Schmitt trigger in the normal way and take the output out after the divide-by-two range. Switching the input and output of the FuL923 gives a 1:1 or 1:2 ratio.

**Use as a tachometer.** The first consideration is voltage—200 to 400 volt spikes appear on the primary of the ignition coil and an integrating/dividing network must be used. A suggested one is shown:

Consideration must be given to the polarity of the earth (if the car source is to be used as a power supply) and the number of cylinders and 2 or 4



Range-to-range accuracy depends primarily on the tolerance of the timing capacitors.

From the above description, it can be seen that the instrument is a useful and flexible piece of equipment to have. It can be made up in a variety of forms depending on the desired use(s).

(From Flying-Officer C. L. Mills, 28 Charteris Drive, East Ivanhoe, Vic. 3079.)

## DARSTAN TRIMMER POTENTIOMETER

wire wound, particularly suitable for transistorised circuits and printed circuit applications. Leads are on printed circuit 0.1" module.

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A high-output Ceramic microphone for effective use in NOISY locations. Features 360° differential cancellation of background noise for sharp, clear speech—has lip-bar to maintain uniform close spacing necessary for consistent high-output modulation—highly recommended for amateur radio, industrial use. Output: -50 db. Response: 100-3,500 cps when microphone is held for close talking with lip-bar acting to maintain a consistent fixed position in relation to the mouth (see photograph). List Price, **\$17.50.**



539

### MOBILE RADIO USE



**Model 511 Ceramic Microphone**  
 A top performer at low cost—has "Super Talk" Power. Response characteristic carefully calculated to give maximum clarity and intelligibility. Inherent design characteristic reduces background noise and feedback. Attractive, rugged and dependable with unusually high output. List Price, **\$12.75.**



511

This is a high-impedance microphone with unusual versatility. Designed to reduce background noise, feedback, hum and rumble. Attractive design and easily handled, the 511 Ceramic Microphone has a host of features for continued and satisfactory performance. Output: 50 db. Response: 200-3,000 cycles, with a 6 db rise at 1,600 cycles for improved clarity and crispness. List Price, **\$19.95.**

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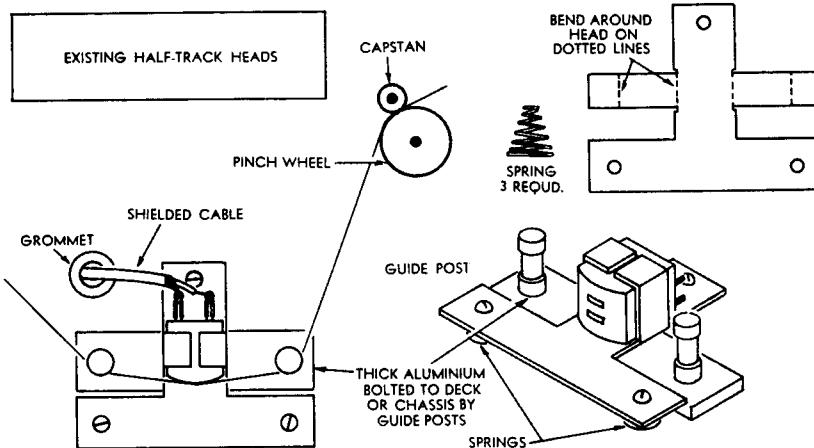


**DN-50**  
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## A Reader Built It – continued



Readers who own a stereo amplifier system and who wish to play back pre-recorded stereo tapes should consider adding a quarter-track stereo tape head to existing mono recorders, preferably without disturbing the existing facilities. It may not be possible in all cases but, where it can be done, the enthusiast will gain a stereo tape playback facility without the expense of a new deck.

By the same token, some may want to add an extra R/P head to make it possible to monitor what is actually being put on the tape — something that cannot be done with the simpler machines.

On some decks, the only space available for an extra head is between the capstan and take-up reel. In this position, reproduction may be subject to some flutter. This would render it unsuitable for high-quality stereo playback but would not necessarily render it unusable as a monitor for what is being put on the tape. The actual material being recorded would not be affected by the presence of the extra head and due allowance for the flutter could be made when monitoring; the important thing, usually, is to verify that the program is, in fact, being captured and that the level and balance are acceptable.

For the reproduction of pre-recorded stereo tapes, as distinct from monitoring, much the better position for an extra head is between the feed spool and the capstan.

Alternatively, there may be room to mount an additional head assembly, complete with guide posts in front of the present head system, so that the tape is re-routed past it, when the deck is to be used for stereo reproduction. This is depicted in the diagram above.

The diagram suggests a method of construction for the additional head unit. The guide posts are bolted directly to the deck with a fixed piece of thick aluminium beneath them to raise them to the same track level, as dictated by the existing mechanism. The assembly carrying the head floats between the guide posts on a T-shaped bracket resting on spiral springs and held down by screws into the deck. By this means, the head height can be adjusted critically to ensure that the gaps scan the pre-recorded track ex-

actly. At the same time, azimuth adjustment can be made, to ensure optimum high-frequency response.

It is important that the output at the tape head should not be earthed to the recorder chassis because of the risk of producing an earth loop. It is convenient to run the pairs of leads through shielded cable down through a small hole in the deck. A DIN type socket, mounted in a convenient position, can provide the necessary connection to the head without involving the earth return leads with the chassis.

Unless the stereo amplifier system

already has an input facility for tape heads, it will be necessary to interpose a separate equalising preamplifier. I am using the preamplifier described in the October, 1965 issue of "Electronics Australia." The current drain is so small that the battery I have been using for more than 12 months has dropped only by 1V. I had to power the preamplifier separately because my amplifier has a positive earth.

Aluminium was used for the metal-work because of its ease of handling. The tape guide posts may be obtained through Goldring Engineering (Asia) Pty. Ltd. The helical springs were made from spring wire obtainable from hobby shops. (From R. Vijayenthiran, Flat 2, No. 31 Malabar Rd., S. Coo-gee, N.S.W., 2034.)

## **BASIC RADIO COURSE**

"Basic Radio Course" is a quarto-size 128-page book published by "Electronics Australia." In its 24 chapters, it starts from first principles and goes on to explain the operation of radio transmitters and receivers. It introduces the reader to test equipment, audio systems, radio servicing, amateur radio and tape recording. Copies may be obtained by writing to "Electronics Australia," Box 2728, G.P.O., Sydney, 2001. Enclose postal note, money order or cheque for \$1.60, which includes postage.

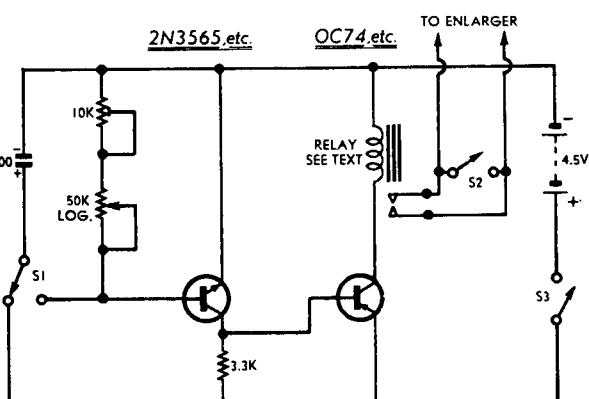
## A SIMPLE PHOTOGRAPHIC TIMER

Here is a simple timer which can make life much easier for anyone who plays "octopus" in a darkroom, trying to do several things at once.

Operation of the circuit is as follows: Assume that S1 is in the re-set position, as shown. When switch S3 is closed (on) the 400uF capacitor charges to the full battery potential. Meanwhile, the two transistors are drawing very little current, the relay is open and the exposure light is therefore off.

When S1 is moved to the "operate" position, the charge across the capacitor causes the first (NPN) transistor to conduct heavily. This creates a large voltage drop across its 3.3K collector resistor, which forward biases the second (PNP) transistor, closing the relay and operating the exposure light. (S2, by the way, allows the light to be switched on manually).

As the charge across the capacitor leaks away through the two resistors, a position is reached where both transistors cease to conduct and the relay drops out. The rate at which the capacitor discharges and therefore the



length of the exposure depends on the setting of the two variable resistors.

I elected to use a potentiometer as the timer control mainly for reasons of economy. A 50K switch pot. serves the purpose and doubles as an on-off switch. The tab pot. sets the minimum exposure, while the main pot. is calibrated against a stop watch.

The power supply comes from a large 4½ volt battery (e.g. an Eveready 703). The relay proved something of a problem, requiring contacts to switch 240V while still pulling in reliably at 15-20mA. I simply modified a miniature relay, bought at a disposals store, by fitting a set of heavy duty contacts. (From P. Vogel, 5 Wilson St, Maroubra, N.S.W. 2035). ■

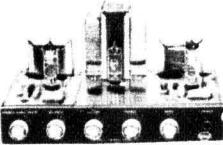
**KITS**

Public Address Units — Geiger Counters — Metal Locators — Decade Boxes — Mixers — Battery Chargers — Oscillators — Bridges — Parts Supplied for Projects in Electronics (Aust.), Wireless World, Practical Wireless, Electronics World, Electronics Illustrated, Practical Electronics, etc.

**KITS****MULLARD STEREO 3-3**

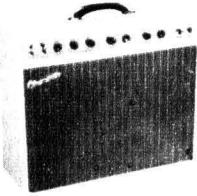
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(As per Mullard leaflet).



**1966 VTVM KIT.**  
ELECTRONICS (Aust.), Feb., 1966.

**BATTERY CHARGER 1A**  
ELECTRONICS (Aust.), Feb., 1966

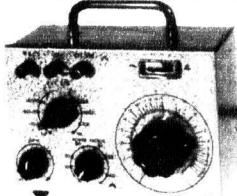


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ELECTRONICS (Aust.), May, 1966.

**REGULATED POWER SUPPLY**  
190-270V D.C. at 40 mA.  
ELECTRONICS (Aust.), June, 1966.

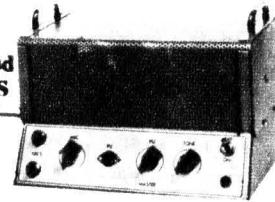


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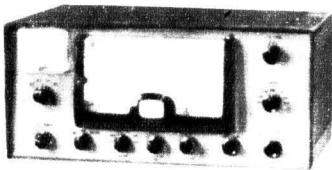


**3-BAND DOUBLE-CHANGE RECEIVER**  
ELECTRONICS (Aust.), April, 1966.

**1966 3in CRO**  
ELECTRONICS (Aust.), May, 1966.

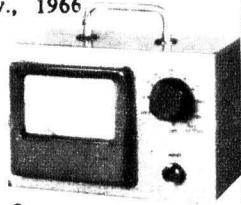
**5 BAND DSB TX**

Electronics (Aust.),  
Nov., 1965.



**FOUR-CHANNEL AUDIO MIXER**  
ELECTRONICS (Aust.) Feb., 1966 & 1967

**3-BAND 3-RECEIVER**  
ELECTRONICS (Aust.), Nov., 1966.

**TRANSISTOR MILLIVOLT METER**

Electronics (Aust.),  
R. TV and H., Jan., 1965.

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18. 1966 VTVM Probes

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27. Pattern Generator

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30. 1962 High Perform-

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31. Crystal Locked Stand-

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32. Electronic Tuning

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35. Square Wave Gener-

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36. Transistor Audio

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37. Additive Frequency

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38. Additive Frequency

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111. Wireless World 20-

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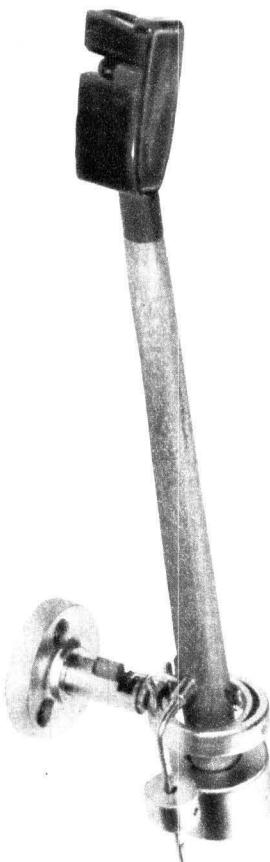
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# AUDIO TOPICS



## Filtering RF interference in audio equipment

RF interference in audio equipment can produce some very unwelcome effects: voices and music from radio transmitters, chirps from radar equipment and, most troublesome of all, sync. buzz from television stations. The following is a condensation of an article from the *Audio Engineering Society Journal* (Vol. 16, No. 2, April, 1968).

by R. S. MacCollister

It is disturbing to find, after installing carefully selected audio equipment, that the local radio or television station comes in at an annoyingly high level on the phono circuits. It is equally distressing to find that these phono circuits are loaded with a background of buzz, reminiscent of 50Hz hum. Yet such experiences have been plaguing the high-fidelity field for years and, subjectively at least, the interferences seems to be getting worse.

The problem is experienced not only by the high-fidelity section of the audio industry. Almost any piece of audio equipment that uses a high impedance input followed by substantial amplification, or that has a high impedance point inside the chassis with substantial amplification after it, can be affected badly by this trouble. Some telephone-answering devices use a crystal microphone feeding a high-input impedance solid-state amplifier, and they too can be affected.

The first reaction of the audio engineer often is to start the usual search for ground loops, heater-cathode leakage, power supply difficulties, and other such causes of hum in audio systems. All to no avail, since the problem is not amenable to correction along these lines. The source of this interference is not even in the audio spectrum and efforts to filter or otherwise control 50Hz and its low harmonics are therefore doomed to failure.

The explanation of this "buzzy" interference lies in the location within built-up residential areas of powerful television transmitters. These transmitters fill the surrounding area with a strong field of RF energy, modulated, among other things, by the synchronisation signals used in all television transmissions. This is the source of that most annoying interference—"TV sync. buzz."

The strength of the offending RF fields is not always recognised. To illustrate: some years ago the writer was called in to diagnose a particularly bad case of buzz trouble. The high-fidelity equipment was from a good maker. The buzz was so bad that steps were taken to record it for use on a

radio program on a local FM station reporting on the situation. Unfortunately, the only valid suggestion that could be made at that time was to suggest the services of a good real estate agent!

The buzz was duly recorded on an Ampex 400 tape recorder and, after successfully getting down a horrendous buzz on the tape, the recorder was disconnected, leaving only a pair of high-impedance crystal phones connected to the monitor jack. It was quite a surprise to find that, under these conditions, with the recorder disconnected from everything except the phones and in the middle of a living-room, the VU meter needle on the recorder was wandering between -2 and 0VU!

Other RF sources will cause similar difficulties: On occasions there is a rhythmic buzz with a sharp crescendo and a diminuendo, repeating with a clock-steady frequency. This is caused by radar.

Again, in a San Francisco high-fidelity store it is possible to place a hand on the head cover of one of the better tape recorders and hear speech and music—from a local station.

On one downtown street of San Francisco a series of tones, repeating at odd intervals, used to appear on all tapes recorded on another recorder; the trouble stopped when the recorder was moved across San Francisco Bay to Berkeley. In this case the cause was thought to be signals connected with the local street railway.

Local "ham" stations can also cause trouble, even though the transmitters involved have been thoroughly worked over to minimise spurious radiation.

Phone dialling pips, light switch clicks, and similar disturbances are in the same class: RF interference.

But the buzz is the worst of all.

In areas where TV sync. buzz is a problem, some locations may be predicted as ones where trouble will be experienced. It has been determined on the basis of the location of troubled equipment as well as by driving around the areas near the TV stations, that the interference is likely to be strong-

est along the transmission lines supplying power to the stations involved. For instance, the home where the wandering VU meter needle was observed is less than 1,500ft from the TV tower and across a narrow street from the power lines to the station.

In a house approximately a quarter mile further away from the station, but not on the power line, there was little difficulty. In yet a third house, over half a mile from the station, there was a great deal of interference in a tape recorder; this house is close to the corner of the street where the power lines come down the hill.

The writer's home is about 2½ miles line-of-sight from the major TV stations in San Francisco. All audio gear must be filtered before adequate signal-to-noise can be attained. TV sync. buzz is so strong that the house is an excellent test spot to see if the audio equipment under examination is or is not immune to this interference, or if filtering is successful.

One of the prime bits of evidence useful in differentiating between sync. buzz and ordinary hum is the fact that the buzz will be affected by persons moving around the audio equipment while it is buzzing, with the volume control turned up to emphasise the problem. Arrangement of the audio cables from the cartridge will affect the character and loudness of the buzz. The buzz can often be minimised by holding portions of the audio cables in the hand; it is a sure sign that the buzz is RF interference if the buzz changes as the hands are moved away from or toward the cables. Proof positive comes when the audio output is displayed on a scope screen. Often the entire TV signal will show up, picture modulation and all!

Having described the problem, what can be done to minimise RF interference? But first an explanation is appropriate as to how the RF signal creates the audio fed to the speakers.

Mostly, the RF interference is picked up by unbalanced, high-impedance cables, as from the phono cartridge to the preamplifier section of the equipment. The cables from tape playback heads to the electronics of the recorder can also pick it up effectively; so can high-impedance microphone cables. Even speaker cables have been known to bring the RF back into the amplifier to cause trouble.

Actually, any cable attached to the preamplifier chassis can bring in the RF; once it gets inside the chassis, the damage is done. The RF affects the grid circuit of the first tube in the amplification chain or the base of the first transistor. At this point, a detect-

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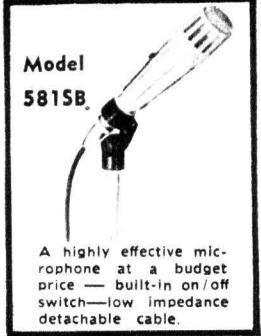
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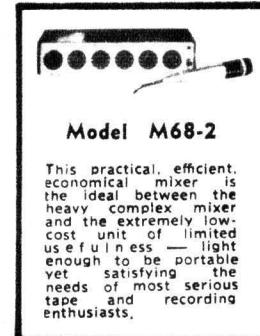
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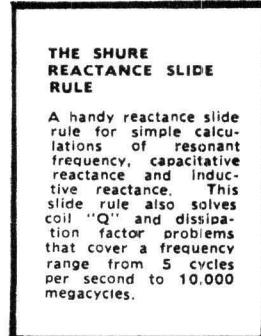
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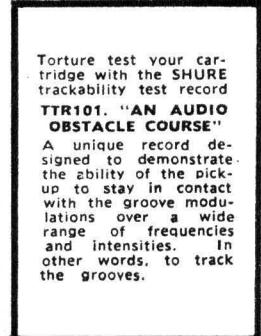
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ing action occurs, causing the audio-frequency modulation on the RF to be passed on up the chain, being ultimately reproduced in the loudspeakers.

To combat the interference, one can attempt to keep the RF out of the system but this is difficult, often impossible. Attempts to "ground" this RF through water pipes or some such are almost always a waste of time. The writer knows of two main ways to cope with interfering RF, and a combination of the two will sometimes overcome the problem completely.

One of them is to extend the shielding effect of the chassis, by placing the cables from the cartridge to the preamplifier section of the equipment inside some heavy, tinned-copper shielding. Sometimes this also helps on cables from the tuner or other auxiliary signal sources. It is important to ground the shield to the preamplifier chassis only, leaving the outboard end unconnected. To do otherwise will create ground loops that will add more hum than the reduction of buzz accomplished. It is sometimes worthwhile to use shielded speaker cables, grounded to the chassis in the same way.

Another idea that may help is to twist the pairs of stereo audio cables together, if single cables are used from the cartridge.

The second and better method is to make the audio equipment itself more immune to the interference by filtering.

It is important to remember that the carrier of the interfering audio is an RF signal normally above 50MHz; hence the futility of filtering in the audio range. Since the main causes of the buzz are synchronisation pips on the TV signal, which are essentially square waves with all the attendant harmonics, it would be necessary to filter sharply a number of discrete frequencies. This is not practicable.

Rather obviously, a lowpass filter somewhere near the point where the RF enters should be considered. It is simply necessary to have a filter with the 3dB point well above the audio spectrum and well below the lowest frequency carrier of the RF interference. This spot is well chosen at about 3MHz. A filter consisting of a 1,000 ohm resistor in series and a 46pF capacitor in shunt will be quite satisfactory. Values are not critical but, since the components are at the beginning of extensive amplification chains, low-noise types should be chosen.

The question remains as to where to put the filter—a most important point if it is to be effective.

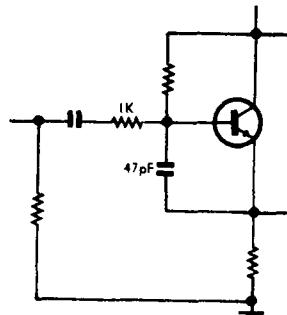
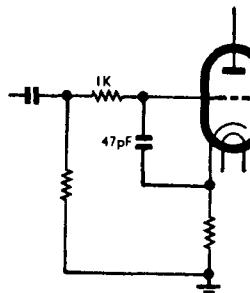
RF filters should be installed as close as physically possible to the actual elements inside the valves or transistors. Obviously, this will be on the socket pins in valve equipment, or at the connection points where the leads of the transistors meet the rest of the circuitry. Thus, the resistor should be installed between the top of the grid resistor and the grid pin of the socket, or the similar place in transistor circuitry<sup>2</sup>. The capacitor should be installed directly on the socket pins for the grid and the cathode of valves, or the equivalent position with transistors, as shown in figure 1.

It should be noted, since the 3dB point of the filter is in the megahertz range, the effect on audio frequency response is negligible.

It will compromise the effectiveness of the filter if there is a resistance between the bottom end of the capacitor and the cathode, or its equivalent in the transistor—hence if the bottom end of the capacitor is connected to chassis instead of cathode (or emitter). The capacitor adds to the interelectrode capacitances of the tube or the transistor. These capacitances will sometimes work by themselves if the series resistor is increased to 10,000 ohms but, for full effectiveness in difficult areas, the added capacitance is necessary.

If the offending carrier frequency is

*To be effective, RF filtering must be installed across the actual input electrodes of the first valve or transistor.*



lower than those used in television transmissions, it may be necessary to lower the 3dB point of the filter by increasing the value of the resistor. The writer has used values varying between 1,000 and 10,000 ohms with success.

It might be thought that it would be effective to place this filter at the input to the preamplifier from the cartridge. This is not the case. The portions of the input jack and the input plug that are inside the chassis, and are therefore before the filter, will act as a transmitting antenna to spread the RF energy all over the inside of the chassis, filter or no. It will be picked up by the leads, detected at the valve or transistor as before, and again appear in the output as background audio.

For this very reason it is sometimes necessary to filter the valves or transistors just after the tone controls in the amplification chain. Tone controls being "lossers," the gain after them is sometimes very high and RF picked up and detected at this point can be almost as bad as that affecting the input.

Some care should be exercised in the installation of the filter in existing equipment. It should never be installed inside a feedback loop. Some trouble may occur in installing filters at the grids of tubes used as first audio amplifiers in power amplifiers that take feedback from the output transformer secondary and apply it to the cathode of the first audio amplifier, since parasitic oscillation can and often does occur in this situation. Any filtering on an existing piece of equipment should be carefully examined with a scope to see that this trouble does not crop up.

This filtering method was first devised for valve amplifiers, but will work effectively with both valve and transistor gear. It has been known to effect a better than 40dB improvement in the signal-to-noise ratio of recent solid-state amplifiers, which is an indication of both the effectiveness of the filtering and the magnitude of the problem.

The writer feels that the engineering staffs involved in the design of audio

equipment are largely unaware of the magnitude of the problem and therefore of the need to combat it. If the foregoing remarks help to underline this need, they will have served a purpose—quite apart from aiding those who have the problem right now, in their own equipment.

#### NOTES

1. This problem has been discussed in connection with the design of solid state preamplifiers. See James J. Davidson, "Low Noise Transistorised Tape Playback Amplifier," J. Audio Eng. Soc. 13, 15 (1965). This designer chose shielding, with particular attention to special grounding, to solve the problem. It is possible to do

this with newly designed equipment, but it is not an attractive proposition for existing equipment in the field. Filtering in the amplifier described in the article would have been risky due to the presence of feedback loops.

2. One must be careful not to disturb DC biasing arrangements in transistor circuits. The important thing is to have the resistor of the filter in series with the signal, and as close as possible to the tube or transistor as circuit conditions allow.

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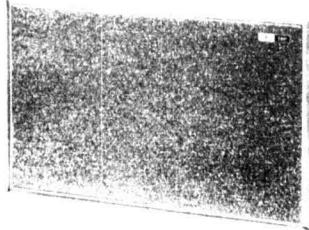
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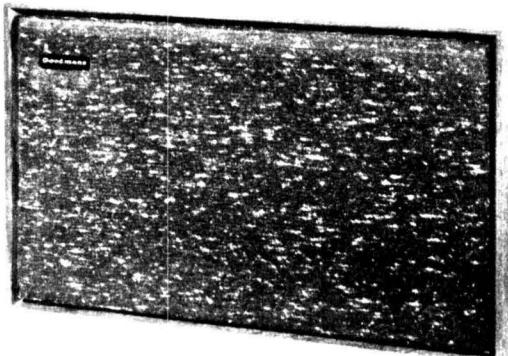


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# Classical reviews

By JULIAN RUSSELL

## Aida — "grandest of grand operas"

**VERDI**—*Aida. Complete Opera.* Birgit Nilsson (Aida); Franco Corelli (Radames); Grace Bumbry (Amneris); Mario Sereni (Amonasro); Bonaldo Gialotti (Ramphis); Ferruccio Mazzoli (The King). Rome Opera House Chorus and Orchestra conducted by Zubin Mehta. HMV Stereo SAN189/91.

This is a good set of what is probably the grandest of all the grand operas in the current repertoire, but I cannot say that I prefer it to the 1962 Decca version, which had the advantage of a production by John Culshaw, an important feature in an opera that relies so much for its effect on the massing of choruses and other ensembles. Moreover, Karajan not only won some beautiful playing from the Vienna Philharmonic, but had a much more idiomatic approach to the music than Mehta. For Mehta, despite some really lovely playing in the brief introduction—tautly linear yet seductive in tone—and in the opening of the Nile scene, has yet to work himself into a true Veridian style.

Nilsson, of course, is better known for her Wagnerian and Straussian roles than Italian ones and might also be criticised by some for her failure to get a really Veridian quality into her magnificent voice. But if this is perhaps missing, her achievement in the role is nevertheless memorable though, perhaps unfairly, one cannot entirely rid one's mind of past performances, especially by Callas and Milanov. Corelli is a robust rather than an alluring Radames. To say that he keeps himself to himself is no great exaggeration of his method in this set. He seldom seems to blend in with the rest of the cast and while he is formidable when he lets himself go, he is anything but beguiling in the too few pianissimo notes he takes.

Grace Bumbry's Amneris is formidable, too, a feature that can be better appreciated in her last scene than anywhere else. Sereni makes a highly acceptable but routine Amonasro. Gialotti an impressive High Priest, but Mazzoli is much less impressive as the King. The chorus and orchestra are well-drilled and display complete unanimity in the many great ensembles. Altogether a good set, but not in the Decca class.

★ ★ ★

**BERLIOZ**—*Symphonie Fantastique.* Paris Orchestra conducted by Charles Munch. HMV Stereo ASD2342.

Paris has for a long time been due for a really first-class orchestra. For many years, there has been none that

might be compared on terms of equality with such organisations as the London Symphony, New Philharmonia, Vienna Philharmonic, Berlin Philharmonic, and the best American orchestras. L'Orchestre de Paris makes its debut on this recording. It was founded last year with the co-operation of the French Ministry of Culture. Its basis is 35 players from the Paris Conservatoire Orchestra augmented to 110 at full strength from other sources. Its resident conductor is one of the best in France, Serge Baudo, but it is not he, but the elder statesman, so to speak, among French conductors who has recorded its first disc.

The result is not altogether as happy or auspicious as one might have wished. Munch's reading is a bit too overblown emotionally in the first movement. I admit that Berlioz did indicate a feverish atmosphere for this music, but he can hardly have had in mind the almost Stokowskian extravagances that Munch glories in here. The best movements are the Valse, and the "March to the Scaffold." The "Witches' Sabbath" finale passes muster, but not the lovely slow movement, "In the Fields," which Munch hurries through as if deliberately avoiding the many difficulties presented by the movement taken at its correctly slower tempo.

With true de Gaulle chauvinism this quite ordinary disc in everything but its debut significance, was awarded the Grand Prix de Disque du President de la Republique. If this means that the General himself was responsible for the award, it is as great a mistake as any he has made recently.

★ ★ ★

**BERLIOZ**—*Beatrice and Benedict. Complete Opera.* Josephine Veasey (Beatrice); April Cantelo (Hero); Helen Watts (Ursula); John Hutchinson (Benedict); John Cameron (Claudio); John Shirley Quirk (Don Pedro); Eric Shilling (Somarone). The St. Anthony Singers and the London Symphony Orchestra conducted by Colin Davis. World Record Club Stereo S/4369/70.

This is altogether much better Berlioz. Indeed there is scarcely a bar that I didn't find enchanting. Strangely, England rather than France seems to produce the best Berlioz conductors. Beecham was peerless, and Davis runs him close enough to be compared without any qualifications. This is all the stranger when one thinks about how odd would be a performance of truly English music — by Elgar or Vaughan Williams, for instance — con-

ducted by a Frenchman. Although the libretto was based, more than 100 years ago, on Shakespeare's "Much Ado About Nothing," Berlioz himself was responsible for its creation. True, he borrowed many scenes from the original, but he simplified the play in order to focus the action on the hit and run quarrels and love-making of the two principal characters.

The music today is as fresh and sparkling as when it was written, and Davis loses no opportunity to make it delicious entertainment throughout. He has the knack of giving Berlioz' long cantilens plenty of room to breathe and expand. Yet you will never get the impression that he is dragging the tempos. All the principals are absolutely first rate, the orchestral playing, by the London Symphony, beyond praise. And perhaps more importantly for some, the two-disc set is issued at a club price as a reissue from the prestigious L'Oiseau Lyre catalogue.

★ ★ ★

**BARTOK**—*Music for Strings, Percussion and Celesta.*

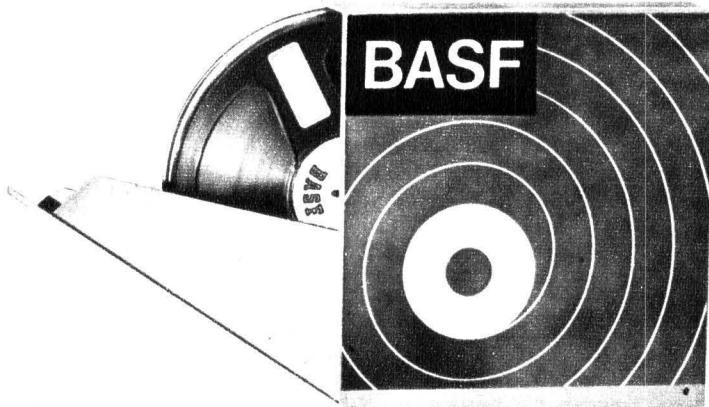
**HINDEMITH**—*Mathis der Mahler (Symphony).* Berlin Philharmonic Orchestra conducted by Herbert von Karajan. World Record Club Stereo S/4368.

This is another excellent buy from the World Record Club. Bartok considered the seating of the orchestra so important to achieve an optimum effect that he drew a sketch of how the musicians were to be placed on the title page of his score. It sounds as if Karajan used exactly this set-up, because Bartok's quite wonderful antiphonal use of his resources is recorded with extraordinary fidelity in its stereo version. There is no doubt about the distinction between the two string groups placed on either side of the percussion. As a result the sound of one group is confined to one speaker, that of the other group to the second. Sometimes they combine with admirable effect.

This is very difficult music to play, chiefly because everything is so exposed. But the Berliners do splendidly. And though Karajan's account might be labelled by some idiosyncratic, I found nothing in his intensely personal reading to impede the natural flow of the music. And to those who are only just starting to really enjoy Bartok's music I can assure them that this suite — I call it that for want of a better name — is among some of his most easily accessible after a couple of runs-through.

I am afraid that I do not respond in the same way to the music of Hindemith, especially the "Mathis" Symphony. Its workmanship is superb but, often though I have heard it, I still remain unmoved by most of its material. I don't think Karajan is quite as at home here as in the Bartok. His tendency to shape a phrase just a thought too lovingly gets by in the Bartok piece, but tends to take the spring out of Hindemith's rhythm. Yet Karajan's sound is unremittingly beautiful, and if I could only work up more enthusiasm for the composition I could perhaps recommend it more energetically. But at the club price asked I think the disc excellent value for the Bartok alone, and if you enjoy the Hindemith, too, so much the better.

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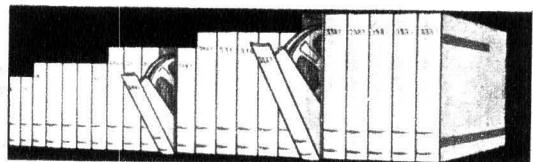


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**MOZART** — Serenade No. 4 in D (K.203). Horn Rondo (K.371). Vienna Mozart Ensemble conducted by Willi Boskovsky. Decca Stereo SXL6330.

Willi Boskovsky and the Vienna Mozart Ensemble have embarked on another integral Mozart venture. Their last, you may recall, was the complete recording of Mozart's Marches and Dances throughout which they maintained a very high standard of performance indeed. Their new series will be the complete Serenades, and if this, their first, is to be any guide to the quality of the remainder they should be excellent. They have started with the "Colloredo," a serenade which shares almost equal popularity with the more temptingly titled "Eine Kleine Nachtmusik." Its nickname, by the way, perpetuates the memory of the Archbishop of Salzburg who made much of the early part of Mozart's life so trying.

Its only real rival is that of the Menuhin/Bath Festival group which recorded the work for H.M.V. last year. It was not one of Menuhin's happiest efforts though, like all Menuhin recordings, it had much to recommend it. Its chief fault lay in a sense of hurry that persisted through most of the movements. You will find nothing to complain about in Boskovsky's tempos, which are at all times rational. If you heard any of Boskovsky's "Marches and Dances" you will, by now, have become accustomed to his group's splendid tone and unanimity of purpose. The same virtues are notable in this new series. And Decca have awarded the players a rich acoustic that suits the playing admirably.

For a fill, Boskovsky includes the Horn Rondo, a work left unfinished but heard here convincingly edited by Erik Smith. The horn playing is first rate in both the Serenade and the Rondo. And a special word of praise must be handed to the solo violinist, Alfred Staar, whose expert and stylish contribution adds much to the enjoyment of the Serenade. A promising start to what looks like being a delectable series.

★ ★ ★

**DEBUSSY** — La Mer, L'Apres-midi d'un Faune, Jeux. New Philharmonia Orchestra conducted by Pierre Boulez. CBS Stereo SBR235262.

There are rumours, I think well founded, that Boulez has abandoned composition for conducting because he has found his latest compositions too difficult for orchestras to play in a manner that satisfies him. I remember a concert Boulez conducted in Vienna in 1965 which included his Mallarme Improvisations, played by the Vienna Symphony Orchestra. There was a slip inserted in the program which announced that this work had taken so long to prepare that there had been no time to rehearse Debussy's "Jeux," the performance of which in consequence had been cancelled.

There may even be some listeners who think that Boulez is such a fine conductor that, so far as they are concerned, he is more gainfully employed conducting than composing. And there are times when I am

inclined to agree with them, despite Boulez' reputation as a composer.

I doubt if Debussy would have altogether approved the broadness of tone Boulez gets from the New Philharmonia in "L'Apres-midi." But whether this is so or not, I can assure readers that Boulez' is the most voluptuous recording of the work I have heard. It is languorously erotic, pervaded by the still heat of a Grecian summer afternoon. I found it all tremendously moving, and while the Philharmonia's tone may perhaps be a little full, it is never coarse.

Boulez raises "La Mer" to full symphonic stature in both the outside movements, though I must admit to some disappointment in the second. As a rule it recalls to my mind the phrase about "yeast and froth" in Shakespeare's "Winter's Tale." But here it obstinately refuses to effervesce. It all sounds just a little too stiff and formal, though the climax, when it comes, is quite overwhelming. But I think Debussy would have been delighted with the sound Boulez produces in "Jeux." Here is true Debussian timbre with jewel-like clusters of notes spraying out from the orchestra with bewitching delicacy.

★ ★ ★

**MAHLER** — Das Lied von der Erde. Dietrich Fischer-Dieskau (baritone) and Murray Dickie (tenor) with the Philharmonia Orchestra conducted by Paul Kletzki.

Adagietto from Symphony No. 5. Philharmonia conducted by Kletzki. World Record Club S/6097/1-2.

To enjoy this beautiful performance you must be prepared to accept a baritone in the part usually sung by a contralto or mezzo-soprano. Mahler himself approved the substitution and I can imagine no baritone more eloquent in this music than Fischer-Dieskau. And he is admirably partnered by Murray Dickie, a tenor who can produce heroic sounds without strain, even in the first movement with its abnormally high tessitura. The orchestra, under Kletzki, has tremendous authority, and although the original was issued some six or seven years ago, the engineering of this reissue stands up well to modern standards. Altogether, another attractive buy at an economy price.

★ ★ ★

**BRAHMS** — Piano Concerto No. 2 in B Flat, Op. 83. Wilhelm Backhaus and the Vienna Philharmonic Orchestra conducted by Karl Bohm. Decca Stereo SXL6322.

There have been many fine recordings of this concerto, but never before has there been such a splendid one made by a pianist on his 83rd birthday. That Backhaus' technique can be felt at times to be under strain should surprise no one. Brahms' Second is a daunting work for even youthful fingers to attack. But these momentary lapses excepted, this is a grand performance, broad in conception and faultless in its sense of style. And as if to celebrate this birthday occasion, both the Vienna Philharmonic and

Decca's sound engineers have given Backhaus glorious tone to support him. Although there are other current versions that I prefer, this is still very fine indeed, and can be judged strictly on its merits without any sentimental consideration of the veteran pianist because of his great age. I found it necessary to cut back the bass a little to get the best out of the engineering, which is otherwise faultless.

★ ★ ★

**NEW YEAR'S CONCERT** — Vienna Philharmonic Orchestra conducted by Willi Boskovsky. Decca Stereo SXL6332.

The program comprises: Johann Strauss — Overture "Cagliostro in Wien" Overture "Das Spitzentuch der Konigen." Waltz "Karnivalsbotschafer." Polka "Leichtes Blut." Josef Strauss — Waltz "Dynamiden." Polka "Die Liebelie." Polka "Moulinet." Waltz "Dorfchwalben aus Osterreich."

Boskovsky also shines as conductor of the great Vienna Philharmonic—of which he is the leader, by the way—in this lighthearted, even festive program. This is music to which you can listen without a care in the world. Indeed, if you start to play it in a non-receptive mood it should soon set you right. You can, if you like, play it right through with complete enjoyment. I found it better to select an item here and there to build my own program. But whichever way you enjoy it, enjoy it you will. Of that, I am certain. ■

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# DOCUMENTARY RECORDS

Reviewed by Glen Menzies

**THE LIVING SHAKESPEARE. THE WINTER'S TALE.** With Eric Portman, Wendy Hiller, Diana Wynyard and Company. Directed by John Hale. World Record Club, Stereo LS/10.

This play is a complex work from that period in the life of Shakespeare which gave us also "King Lear" and "The Tempest." All of them are regarded as being among the more "difficult" of the author's works. But in the past couple of decades they have begun to be looked at once again.

Inevitably this version of the play, like that of "Hamlet" in the same series, has undergone some compression in order to fit everything on to a single disc. We are of course not so familiar with the general structure of "The Winter's Tale," because unlike "Hamlet" it has not had the benefit of being made into a feature film. Films have undoubtedly added to the better appreciation of Shakespeare's works in recent times.

What the editor of the text has done is to adapt it to the limitations of his medium, leaving out those parts of the play which depend on visual impact to make their full effect. In a very informative cover-note, Professor Esther Jackson, of Atlanta University says: "This adaptation emphasises the tragic-comic progression at the aural level. It is concerned primarily with the exposition of the character of Leontes and with the examination of those psychological relationships which affect him through suffering to reconciliation. The play that remains is essentially a psychological study of the immediate crisis around which the play develops."

If a play of this complex nature is to be presented successfully in this shortened form then three good voices are needed for the leading roles. We have them on this disc. Eric Portman gives a powerful portrayal of the split personality of Leontes, with his mind filled with doubts and suspicion. As the gentle Hermione, Diana Wynyard is touching; and in the commanding part of Paulina, Wendy Hiller is both eloquent and compassionate.

The large supporting cast complements the work of the three leads and Morys Bruce brings authority to the part of the narrator.

The only serious criticism I would make is in relation to the start of Act 4, set in Bohemia, where Autolycus enters singing and has a lengthy conversation with the Clown. This all sounds just a little bit "hey-nonny-no" and could have been shortened somewhat.

In the "sound-staging" of this record good use has been made of the possibilities offered by stereo for giving the impression of movement and the comings and goings that are natural to a live presentation. As usual with the records from this source, the pressing is of high quality with very quiet playing surfaces.

**"WHAT PASSING BELL."** A commemoration in prose and poetry of the fiftieth anniversary of the outbreak of World War I. With Jill Balcon, Hugh Burden, Michael Horden, C. Day Lewis, John Stride, Gary Watson, Patrick Wymark. Edited and produced by Frederick Woods. Argo R. G. 505 Mono.

1964 marked the fiftieth anniversary of the beginning of World War I, and since then there has been considerable re-thinking on the part of writers, historians and particularly documentary makers about the background to, the conduct of, and the aftermath of the "war to end all wars." In purely visual terms, perhaps the finest example to date has been the BBC's magnificent TV documentary "The Great War."

The subject is still, at any rate, a very live topic and for this reason I asked the distributors of Argo Records in Sydney to let me have a copy of this disc to review. "What Passing Bell" is a brilliant and often moving anthology in the form of poems, letters, reports and excerpts from articles presented by a highly talented team of readers and actors.

The apt title of the anthology comes from "Anthem for Doomed Youth," one of the most famous of the poems written in the trenches by Wilfred Owen who, like many of the authors represented here, was killed in the war. His works on this record are read most beautifully by the present Poet Laureate, C. Day Lewis.

The material, mostly written during the war, has been chosen to throw light afresh on the many aspects of the war — the heroism, the futility, the pomposities of Generals and the insularity of the people back home.

This anthology makes us sharply aware of the comradeship of the strange front line world that the soldiers had to try and make the best of, as in a letter from a soldier describing that incredible Christmas when the men of both sides fraternised with each other. As J. B. Priestley said of this war, "It clearly separated combatants from non-combatants, keeping the combatants, if it failed to maim or kill

them, in its nightmare world of trenches and barbed wire and shell holes, perhaps for years."

Whilst the presentation of this feature is done with calm understatement, the effect is both dramatic and thought-provoking, and there is a sense of irony. No commentary is needed; the words have their own immediacy. Frederick Woods has juxtaposed the material with a skilled ear which brings out the humour and the tragedy of the war and especially the Western Front. But "What Passing Bell" is not just concerned with an event that took place half a century ago, it has something to say about all wars.

This is an unique anthology which can hold pride of place in anyone's collection. Its appeal is strong both as history and for the moving quality of the "war poets" who are represented.

★ ★ ★

**THE SENTIMENTAL BLOKE.** The Australian Broadcasting Commission presents Albert Arlen's musical adaptation of the story in verse by C. J. Dennis. The augmented A.B.C. Melbourne Dance Band and chorus conducted by Frank Thorne. With Neil Williams, Janet Crawford, Jimmy Hannan, Jill Perryman, Bobby Bright and Muriel Luky. RCA Camden Stereo CAMS 130.

In just over 50 years since it first appeared in 1915, "The Sentimental Bloke" has become something of a classic with its own unique place in Australian literature. The story of "Bill" and his love for "Doreen" has endeared the name of C. J. Dennis to thousands of readers.

It has been the inspiration of two films, a stage play, a television ballet and, in the 1960s, a very successful musical. Many people still have warm memories of the excellent full scale production of the musical presented just a few years ago. Since then it has been taken up and produced with great enthusiasm by many semi-professional groups.

This album gives us a very polished presentation of the music and songs from the show. The overall standard is so good that it makes one wonder why more albums of this nature are not produced here.

Neil Williams is in top form and makes the most of all the good songs that Albert Arlen has given the "Bloke" to sing. Jill Perryman is a natural as "Doreen" and she projects the character with all the confidence and aplomb of an old trouper. Janet

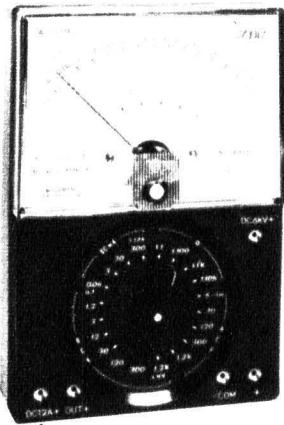
(Continued on page 155)



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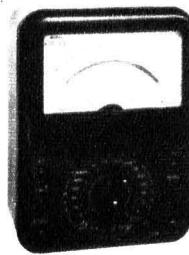


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Batteries	1.5V×1 and 22.5V×1
Size	170×116×59mm

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AC voltage : 3V 12V 30V 120V 300V 1.2kV · 5kΩ/V

AC current : 1.2A 12A

Resistance : Range    ×1    ×10    ×100    ×1000  
Midscale    40Ω 400Ω 4kΩ 400kΩ  
Maximum    5kΩ 50kΩ 500kΩ 50MΩ

Volume level : -17~+63dB

Accuracy. Within ±2% (10% for 6kV and above) fsd for DC voltage.

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Size & weight. 179×133×85mm & 1400 gr

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DC current : 50μA 0.5mA 5mA 50mA 250mA

Resistance : Range    ×1    ×10    ×100    ×1K  
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Maximum    5kΩ 50kΩ 500kΩ 5MΩ

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# VARIETY FARE

Reviews by: Neville Williams Harry Tyrer  
T. Forbes Cameron

## Devoational

**PAUL SPEAKS.** Selections from "Living Letters," the paraphrased epistles by Kenneth N. Taylor. Narrated by Russ Reed. Mono, Word (Gospel Film Ministry) W-3384-LP.

Interest: Scripture readings.

Performance: Most impressive.

Quality: Virtually flawless.

Many thousands of copies of "Living Letters" were distributed some years ago under the auspices of the Billy Graham Evangelistic Association. The book is a paraphrase in modern English of the New Testament epistles and, as such, is widely used in study groups.

However, I doubt that many will have appreciated the genius of the paraphrase and the flow of language and logic, as becomes evident in this reading by Russ Reed. Himself Hebrew Christian and a professional radio and television actor, Russ Reed begins the epistle to the Romans in a quiet friendly manner, but becomes progressively more enthusiastic as he—in the role of Paul the writer—develops the theme of the Christian's heritage. On side two, as Paul turns his attention in another epistle to those who have reputedly challenged his authority, the dignity of the early excerpts gives way to a tone of contention and self-justification. This is more than just a reading; it is a full-scale characterisation of the great evangelist, which highlights not only the message of the epistles but the very human qualities of the man who wrote them.

If criticism is warranted, it would be that nowhere on the jacket are the excerpts positively identified, so that the listener who may want to follow the reading or examine the context has a hunt in front of him. But don't let this remark put you off. As a scripture reading, this is quite outstanding. (W.N.W.)

★ ★ ★

**HAPPY SOUNDS OF FAITH.** Boots Randolph, Stereo, Monument (Festival) SPL-932,896. Also in mono PL-32,896.

Interest: Swingin' Gospel.

Performance: Yes, happy!

Quality: Very good.

Stereo: Well spread.

Writing his own jacket notes, well known saxophonist Boots Randolph claims that his first opportunities as a featured artist came in Gospel meetings conducted by itinerant evangelists. Now, many years later, he has produced this album of Gospel and devotional favourites, played in the spirit of those early meetings but, I imagine, with a lot more polish and far more

competent backing.

With organ, bass and percussion, plus other instrumental and vocal backing, he produces a happy sound indeed, using titles that should be familiar to all Gospel devotees: When The Saints Go Marching In—Just A Closer Walk With Thee—Will The Circle Be Unbroken?—Peace In The Valley—Amen—The Lord's Prayer—I Believe—You'll Never Walk Alone—May The Good Lord Bless And Keep You—Ave Maria.

The quality and stereo are excellent and there is a lot of weight in the bass, without it ever becoming tubby. Recommended for the younger generation in particular, and for the older ones too—provided you are not averse to the more modern treatment. (W.N.W.)

★ ★ ★

**WE'LL KEEP A WELCOME.** The Morriston Orpheus Choir. Conductor Eurfrlyn John. Accompanist Jennie Sims. Stereo, Columbia SCXO-6211.

Interest: Male Voice Choir.

Performance: Superb.

Quality: Virtually flawless.

Stereo: Beautifully spread.

This new album by the Morriston Orpheus Choir contains several devotional numbers and, for this reason, is included in this section. The remaining numbers and their presentation are certain to appeal also to anyone interested in choral music, whether devotional or secular. In every way, the choir excels—in balance and blend, dynamic range and in its unity of response to the conductor. As in earlier recordings, Jennie Sims provides excellent accompaniment.

The titles: The Holy City — Own

Rhondda—Hiraeth—March, Men Of Harlech—All Through The Night—Bless This House—Land Of My Fathers—Jerusalem (And Did Those Feet In Ancient Times)—Ave Maria—Steal Away—Myfanwy—We'll Keep A Welcome.

There is a slight rustle of background ambient behind the softer passages and rather obvious breath noises on occasions, but the massed voices are reproduced so cleanly in even the loudest passages, are so well spread and so enriched by natural reverberation that full marks must be awarded to the recording engineers. Playing time is about 35 minutes. Recommended." (W.N.W.)

★ ★ ★

**THE MORMON TABERNACLE CHOIR'S GREATEST HITS.** Volume 2. Director, Richard P. Condie. The Philadelphia Orchestra, conductor Eugene Ormandy. Stereo, CBS SBR-235264.

Interest: As per title.

Performance: High standard.

Quality: First rate.

Stereo: Effectively spread.

The sprinkling of devotional numbers in this mixed program of "Greatest Hits" would not normally qualify this album for mention in this section. However, anyone interested in "We'll Keep A Welcome," also reviewed here, will inevitably want to consider this one alongside it.

Whereas the EMI album is characteristically English, this one is no less strongly American in its flavour. The choir is mixed rather than male, massive (a potential 375 voices) and supported in the more dramatic excerpts by a full symphony orchestra.

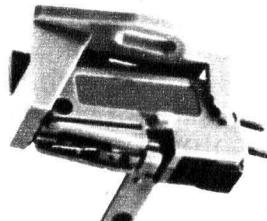
The titles: O Columbia, The Gem Of The Ocean — Londonderry Air — This Is My Country — Beautiful Dreamer (Stephen Foster) — Land Of Hope And Glory (Pomp and Circumstance No. 1, Elgar) — Dixie — Father In Heaven (Bach-Gounod) — The Battle Cry Of Freedom — Hallelujah, Amen (Handel).

As noted, the quality and stereo are of a high standard, the surface is quiet, the jacket notes are adequate. Whether you prefer this album or "We'll Keep A Welcome" will depend largely on the content. (W.N.W.)

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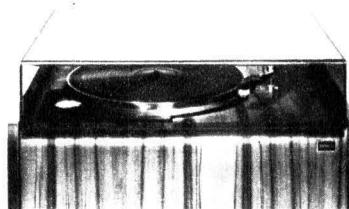
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# Instrumental, Vocal & Humour

**VIENNESE PROM. CONCERT.** Sir John Barbirolli conducts the Halle Orchestra. Studio 2 Stereo, EMI Promenade Series SCXO 7888.

Interest: Orchestral sound spectacular.

Performance: Difficult to fault

Quality: Very good.

Stereo: Effective, natural spread.

The opening stanzas of "On The Beautiful Blue Danube" (Johann Strauss 2nd) give little promise of what is to follow — routine music and routine orchestral sound. But then comes "Thunder and Lightning Polka" by the same composer, with a tremendous sonic impact that will bring any hi-fi enthusiast forward in his seat. The next two tracks provide a feast of varied orchestral sound that likewise have a wealth of hi-fi appeal: "Overture to the Gypsy Baron" and "Perpetuum Mobile," both by Johann Strauss 2nd.

On side 2 are four more established Prom. favourites, again well played and well recorded: Radetzky March (Johann Strauss 1st) — Gold and Silver Waltz (Lehar) — Waltzes from Der Rosenkavalier (Richard Strauss) — Champagne Polka (Johann Strauss 2nd).

If you have a place in your collection for a Promenade concert selection, this one would be hard to beat. And it will be hard to beat also, if you want some full-weight orchestral sound to evaluate and demonstrate your amplifier equipment. The playing time, by the way, is a full 50 minutes. (W.N.W.)

**GOLDEN VIBES.** Lionel Hampton, with reed and rhythm. Stereo, Harmony (CBS) HAS-105.

Interest: Gentle, melodic rhythm.

Performance: Copybook.

Quality: Excellent.

Stereo: Three-channel presentation.

In 1936, Lionel Hampton joined the Benny Goodman band. Since then, he has personally featured on vibes, piano and drums. He has made a name as a bandleader and earned the description of "jazz evangelist."

Here he is on the vibes again, backed by reeds, piano, guitar, bass and drums. Some of the numbers belong to soft lights, some swing gently, some keep the percussion and bass quite busy, but they're pleasantly varied and tuneful: My Prayer — My Funny Valentine — Satin Doll — The Nearness of You — Vibraholiday — The High and The Mighty — Smoke Gets In Your Eyes — But Beautiful — Just You, Just Me — Blues In Gold — The More I See You.

If you don't have a vibes record in your collection this would be a good one to hear. (W.N.W.)

**PROJECT 3 TOTAL SOUND SPEC-TACULAR.** Enoch Light and the Light Brigade. Universal Record Club Stereo.

Interest: Popular tunes in hi-fi.

Performance: Magnificent.

Quality: Demonstration standard.

Stereo: The same.

As far as I know, this is the first

time that any of Enoch Light's new "Project 3" recordings have been issued at anything other than full list price. This is a particularly good example of the art of Enoch Light, which has kept him in the forefront of high fidelity recording since the introduction of the stereo disc. In addition to the extremely life-like sound which is characteristic of Light's work, this disc offers some of the best known names in the field of popular music in America today, including Tony Mottola, Doc Severinsen, Stanley Webb and Robert Maxwell.

Using very fine arrangements by Lew Davies, the band presents the following 12 tunes: April in Portugal — Without You — Come on, Come On — What a Difference a Day Makes — Perhaps, Perhaps, Perhaps — Maria My Own — And We Were Lovers — Born Free — The Alphabet Murders — Who's Afraid of Virginia Woolf? — Alfie — Mirror, Mirror, Mirror.

Fine entertainment, and a disc which can be recommended at the club price asked. (H.A.T.)

**THE MERRY WIDOW** and other wonderful waltzes by Franz Lehar. The London Proms. Orchestra conducted by Robert Sharples. Stereo, RCA Victrola VICS-1106.

Interest: Lehar's waltzes.

Performance: Full, flowing.

Quality: Excellent.

Stereo: Normal spread.

What can one say about "The Merry Widow" and other such well known waltzes, except to remark once again on their old-world association with stage, costumes and gilded ballrooms? And who can fail to respond to their strong, flowing melodies?

Here they are played competently and generously by the London Proms. Orchestra, in a performance made available as a re-issue on RCA's economy Victrola label. The six waltzes: The Merry Widow — Eva — Gypsy Love — Gold And Silver — Wild Roses — The Count of Luxembourg. As the notes point out "Wild Roses" is not widely known but it certainly deserves a place in this album.

Altogether, this is a very pleasant 40-odd minutes of music, well played and well recorded. Recommended. (W.N.W.)

**LOOK AROUND.** Sergio Mendes and Brasil '66. A and M (Festival) Stereo SAML-932,827. Available in Mono.

Interest: Brazilian style music.

Performance: Cool and elegant.

Quality: Very good.

Stereo: Well spread.

If you have a liking for the coolly elegant music of the current breed of Brazilian musicians, this disc will be very much to your taste. Pianist Sergio Mendes is one of the best known musicians in the popular field in his native Brazil, and became known to a wider audience when he recorded a disc for Atlantic last year. Now he has transferred his allegiance to Herb Alpert's A and M company, this being his first release on that label. The playing here is very cool indeed and is certainly elegant and tasteful. Sound

quality is as good as one could wish, and the selection comprises: With a Little Help from My Friends — Roda — Like a Lover — The Frog — Tristeza — The Look of Love — To Say Goodbye — The Beat — So Many Stars — Look Around. Worth Investigation by Bossa Nova lovers. (H.A.T.)

★ ★ ★

**IMPROVISATIONS.** Ravi Shankar (sitar) assisted by Kanai Dutta (tabla) and group of jazz musicians. Liberty (Festival) Stereo SLYL-932,850. Available in mono.

Interest: Indian music.

Performance: Reasonably successful experiment.

Quality: Excellent sound.

Stereo: Good spread.

In common with some Western musicians, Ravi Shankar has been examining the possibilities of a fusion of the Indian traditional and Western jazz styles. On side one of this record, he presents his ideas in this direction, in a piece called "Fire Night." In this he is aided by American jazz musicians Bud Shank, playing flute, Dennis Budimir (guitar), Gary Peacock (bass) and Louis Hayes (drums), combining with a group of Indian musicians. The Indian instruments used are all percussive (Ravi does not perform himself

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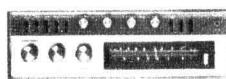
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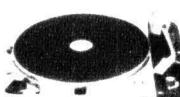
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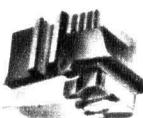
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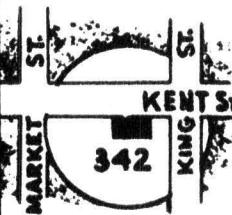
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in the piece). Ravi composed the melody and the musicians have improvised in true jazz fashion. The piece is interesting, but I hardly feel it is likely to set any pronounced trend at this stage.

Side one also has improvisations on the theme written by Ravi Shankar for the film "Pather Panchali." This has some attractive features, including an appealing little melody played by Bud Shank on the flute (the Western variety, not the Indian bamboo flute), but I did feel that the continual repetition of this theme was rather overdone. The disc is completed by two ragas, the first, "Kiruvani," being in the Karnataki style of southern India, and fairly short; while the second, "Raga Rageshri" is a full length evening raga with the usual elements of Alap, Jor and Gat. Those familiar with such matters may be interested to know that the Gat is in Rupak tal of seven beats. (H.A.T.)

★ ★ ★  
**BOOTS RANDOLPH**—With the Knightsbridge Strings and Voices. Monument Records (Festival). Stereo SPL-932,733.

Interest: Only for Randolph devotees.

Performance: Dull.

Quality: A very full sound.

Stereo: Well balanced.

Tenor saxophonist, Boots Randolph, is said to enjoy considerable success in America, playing what his record company used to describe as "yakety sax." But on this album Randolph is more subdued, the majority of the tunes being well-known ballads, including "Who Can I Turn To," "People," "Love Letters" and Errol Garner's "Misty."

With the generous assistance of the echo chamber, Boots Randolph has a big and rather dramatic sound on tenor saxophone. Personally, I find his broad vibrato and honky, staccato tone a bit too much and his phrasing, too, is corny and wooden. His playing, which sometimes runs dangerously close to poor taste, is cushioned a little on this occasion by Bill Justis' competent arrangements for the Knightsbridge Strings and Voices.

I would imagine that Boots Randolph admirers will wait to add this album to their collections. For the uncommitted, 34 minutes of his rather eccentric tenor would surely be much too much. (T.F.C.)

★ ★ ★  
**I LIKE DEBUSSY**. Samson Francois, piano. Capital (E.M.I.) Stereo.

Interest: Popular Debussy.

Performance: Magical.

Quality: Wonderful.

Stereo: Not effective.

This is not a bit like the other discs in the "I Like . . ." series, since it consists of a straightforward piano recital of music by Debussy, played by France's leading pianist, Samson Francois, the idol of the present generation of young concert-goers in that country. Like the others, this disc is intended to be mood music, and as such is perfectly satisfactory, the pieces chosen being suitable for a quiet relaxation without too much effort of concentration. However, the playing is of such a high standard that the disc can easily compete with the best of discs intended for concentrated listening. The titles are: L'Isle Joyeux —

La Fille au Cheveux de Lin — La Cathedrale Engloutie — La Dance de Puck — Minstrels — La Plus que Lente — Pour le Piano — Etude "Pour les Arpeges Composees" — Claire de Lune and Passepied from "Suite Bergamasque."

These pieces are all so well known that comment seems to be redundant, and I will only add that the sound quality is of excellent standard (H.A.T.)

**SENSATIONAL!** Mario Said, piano, with orchestra. Liberty (Festival) Stereo SYL-923,944. Available in mono.

Interest: Mood music a la piano. Performance: Pleasing style. Quality: Excellent. Stereo: Very good.

Most things about this disc are extremely pleasing. To begin with, the classically trained pianist, Mario Said, contributes sensitive melodic contributions which never come into conflict with the orchestral backing; the supporting players are skilful exponents of this kind of mood music; and the sound quality is outstandingly good.

It is in the selection of tunes that the disc becomes patchy, for my taste at least. There are some delightful tracks — Simon and Garfunkel's "Scarborough Fair" being the highlight of the disc for me, with Said's piano work a sheer delight — but some of the numbers seem out of place. The first two pieces on the second side, "We Can Fly" and "Spooky" are described as rock percussion, and are typical of teenage pop music (my unfavourable reaction to these is, of course, purely subjective) and on the same side there is a tasteless up-tempo version of the first movement of Beethoven's "Moonlight" Sonata.

The rest of the numbers, all pleasant listening, are: Don't Sleep in the Subway — By the Time I Get to Phoenix — Hey Girl — Walk Away Renee — Free Again — Theme from "Valley of the Dolls" — Release Me — The Importance of the Rose. (H.A.T.)

**CARLOS MONTOYA.** Suite Flamenca with symphony orchestra. Four flamenco solos. United Artists (Festival) stereo SUAL-932,918.

Interest: Flamenco artist. Performance: Masterly. Quality: Very good. Stereo: Normal.

In the sleeve note, Montoya tells how it has been his ambition to write a suite for guitar and orchestra, using flamenco techniques, for 25 years. Finally he got together with Julio Esteban, who is presumably a fully trained composer, and together they wrote this "Suite Flamenca." The main question is, how can you unite the improvisatory nature of true flamenco with the rigid discipline of symphonic music? Montoya's answer is to insert long cadenza passages into the work, where he improvises happily while the orchestra remains silent. The work is attractive to hear, with typical Iberian thematic material, fully endowed with the plaintive Andalusian cadences and with frequent passages in the minor keys. Montoya's guitar work is, of course, masterly. However, I did feel that the work as a whole lacked unity. It is obvious where the work of Esteban ends and Montoya's begins.

On side two, Montoya plays four typical flamenco pieces: Rondena — Zambra — Guajiras — Huelva. I have heard them all before, but they still sound fresh, principally, I suppose, because Montoya is a true flamenco artist who, while working within the same framework each time, introduces different improvisations at each performance. (H.A.T.)

**A CERTAIN MR JOBIM** — Antonio Carlos Jobim. Warner Bros. (CBS) Stereo WS1699.

Interest: Contemporary Brazilian music. Performance: Gentle and pleasant. Quality: Excellent recording. Stereo: Evenly spread.

Antonio Carlos Jobim is fast gaining international popularity not only for the many excellent songs he has composed (like "The Girl From Ipanema," "Desafinado" and "Meditation"); but also for his highly successful television appearances and recording sessions with great artists like Frank Sinatra.

He is accompanied, for the third time, by Claus Ogerman, who wrote some delicate and sensitive arrangements for this album. The orchestra, which includes the great Brazilian drummer Dom Um Romao and, I think, Urbie Green on trombone, plays beautifully, with the flute section particularly outstanding.

All ten tracks are Jobim's own compositions. Five of them have vocals by Jobim while the others are instrumentals, featuring his simple but attractive guitar and piano.

Technically, he is not a good singer

but his voice has a plaintive, rather engaging texture. Unfortunately, he sings in English, not Portuguese, which detracts a little from the charm and grace of the melodies. The best tracks on the album are well-known compositions like "Bonita," "Desafinado," "Once Again" and "Estrada Do Sol," but all have the Jobim magic.

The only serious complaint I have about this enjoyable album is the poor playing time of just over 26 minutes. (T.F.C.)

★ ★ ★

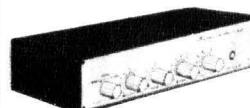
**THE BOARD OF DIRECTORS** — Count Basie and the Mills Brothers. Dot Records (Festival) Stereo SZL-932-803 (also available in mono).

**HALF A SIXPENCE** — Count Basie. Dot Records (Festival) Stereo SZL-932-874 (also available in mono).

Interest: Mainly for big band enthusiasts. Performance: Average Basie, excellent Mills Brothers. Quality: Both superbly recorded. Stereo: Good separation and balance.

These two Count Basie albums were recorded within ten days of each other in November, 1967. The Count Basie Band is, of course, an extremely professional and musically organisation but their record sessions over the last few years have tended to be on the dull side, due to unhelpful and often poor material.

The tunes from "Half a Sixpence" are uninteresting — at least out of context — and arranger Chico



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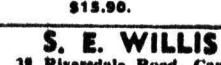
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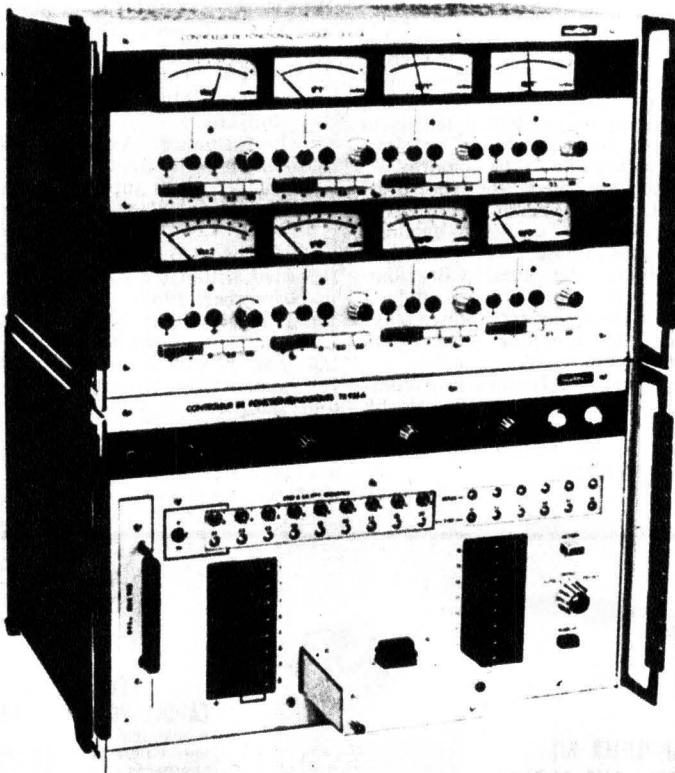
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O'Farrill could apparently do little more than write straightforward melodic statements for the band. To break the monotony, there are constructive solos by trumpeter Al Aarons, trombonist Richard Boone and tenorist Illinois Jacquet, making a very welcome, if temporary, return to the Basie fold. But they, too, were obviously limited severely by the inappropriate material.

The Basie Band displayed much the same sort of musical form on the album with the Mills Brothers. But this was obviously a considerably happier session with the Band more relaxed and swinging. The Mills Brothers, always beautifully in tune, show more than a trace of jazz origins with their rocking, rhythmic singing (they have recorded, during their 35 years at the top, with Louis Armstrong, Ella Fitzgerald, Duke Ellington and Cab Calloway).

Dick Hyman's arrangements for the Basie Band are very good indeed but, of course, he had the advantage of wonderful songs like "Lazy River," "April In Paris," "I May Be Wrong" and "December." "The Board of Directors" is nostalgia of the most satisfying kind and I enjoyed every minute of this album. (T.F.C.)

★ ★ ★

### VIENNA, CITY OF MY DREAMS.

Erich Kunz, bass baritone. Columbia (E.M.I.) mono OSX 7857.

Interest: Popular songs of Vienna.

Performance: Authentic.

Quality: Satisfactory.

Despite the similarity in titles, this disc is just about as different from the Kostelanetz record reviewed last month as it could be. The only common feature is the inclusion of Sieczynski's song "Vienna, City Of My Dreams." Here, veteran bass baritone Erich Kunz sings 16 of the songs which the Viennese like to sing and hear. I feel there is no point in listing the 16 titles, since they will mean little or nothing to those not familiar with Vienna and its peculiar dialect of German — apart from the famous song named above — and except for Johann Strauss, even the composers' names will not be familiar. There are no translation of the texts, and I imagine this disc will have limited appeal to those to whom Vienna is just a name. On the other hand, if you know Vienna, and have nostalgic memories, this could be just right for you. The singer is a native of Vienna, and accomplished. The sound, in mono only, is of good standard. (H.A.T.)

★ ★ ★

### THE BEAUTIFUL BALLADS — Nat King Cole. Capitol (EMI). Stereo ST2820 (also available in mono).

Interest: Previously unavailable ballad tracks.

Performance: Not an outstanding album.

Quality: Average.

Stereo: Not very significant.

Although it is more than three years since the tragic death of Nat King Cole, his records are still as popular as ever.

To the best of my knowledge, these tracks are making their first appearance and, although no discographical details are given, I would guess that they all date from the early 1960s. Certainly they are the product of

several recording sessions, since Ralph Carmichael, Les Baxter and Nelson Riddle all contributed arrangements.

With the exception, perhaps, of his very commercial recordings, Cole was an extremely consistent singer and he is in fine voice here. Unfortunately, there is really not an outstanding song among the 11 ballads on this album and some of the tracks would, I am sure, never have been released in normal circumstances.

For Nat King Cole's many admirers, this will, of course, be an essential acquisition, but it should be said that there are much better albums still available in the Capitol catalogue. The playing time, too, is thin at just over 30 minutes. (T.F.C.)

★ ★ ★

**ROBERT GOULET ON BROADWAY, Volume 2. Stereo, CBS SBO-233500.**

Interest: Popular vocalist.

Performance: Vital.

Quality: Excellent.

Stereo: Good spread, definition.

Through an era when gimmick vocalists have been so much to the fore, Robert Goulet has stood out as one of those old-fashioned, strongly masculine singers; an artist who can handle big show numbers with such assurance: Ciao Compare — Mame — What Is A Woman? — Shalom — When Did I Fall In Love? — The Impossible Dream — Cabaret — There But For You Go I — Walking Happy — My Cup Runneth Over — If She Walked Into My Life.

The orchestra, under Irwin Kostal in some numbers and Marty Manning in others, turns on a fine performance. Stereo spreads it right across the sound stage, while Robert Goulet stands firmly on centre stage. A good record from every viewpoint. (W.N.W.)

★ ★ ★

**A PORTRAIT OF RAY — Ray Charles, Ampar (Festival). Stereo SML-932,898 (also available in mono).**

Interest: Charles at his most superficial.

Performance: Dire.

Quality: Well recorded.

Stereo: Good balance and separation.

Ray Charles has made some mediocre albums in his day but never, in my experience, has one turned out as superficial and banal as this. His Atlantic recordings were by far his most successful and, for me at least, the more piano he played and the less he sang, the better.

He works in an uncomfortable area of music, a kind of amalgam of blues, gospel, jazz and pop influences. On this record, Ray Charles, the tasteless pop singer, is much to the fore.

The first side is particularly agonising, with Charles wringing every ounce of emotion, every tortured rasp from innocuous songs like Jerome Kern's "Yesterdays" and "Am I Blue." To make matters worse, he is accompanied by dulcet strings and voices.

The second side is certainly an improvement with an orthodox big band under the direction of Oliver Nelson but the songs are still paper-weight. I would be surprised if even the most dedicated admirer of Ray Charles

could summon genuine enthusiasm for this album. (T.F.C.)

★ ★ ★

**SONGS OF TRAGEDY. Hank Snow. RCA Stereo LSP-2901. Available in Mono.**

Interest: Veteran C. and W. singer.

Performance: Typical of the kind.

Quality: Very good.

Stereo: Wide separation.

The tired, drawling voice of Hank Snow, with its slightly gravelly edge, is archetypal of the C and W singer, and with 36 years' recording experience behind him, he must be regarded as the doyen in this field. Here he presents a collection of tear-jerkers beloved of C and W fans. The 12 tracks include: The Prisoners' Song — The Colour Song — Walking The Last Mile — Old Rover — The Prisoner's Dream — Little Joe. Besides his own guitar accompaniment, Hank is supported by instrumentalists and small choir, the latter being confined to the right channel and recorded at low level. Originally released in the U.S.A. in 1964, the disc is not Dynagroove, but is still excellent technically, with clear sound, low distortion and quiet surface. The stereo is a bit on the gimmicky side. (H.A.T.)

★ ★ ★

**I HAPPEN TO LIKE NEW YORK. Caterina Valente. World Record Club. Stereo S/4384.**

Interest: Popular vocalist.

Performance: Warm and happy.

Quality: First class.

Stereo: Good spread.

Here making her third appearance within 18 months on the World Record Club label, Caterina Valente is no stranger to club members. Here she sings the famous songs associated with Broadway, Manhattan, Chinatown — in fact, New York. I do not like New York but I happen to like Caterina Valente and, as far as I am concerned, it matters little whether she is singing about New York, Moscow or Kalgoorlie, as long as she sings as charmingly as she does here.

In her warm and happy style, versatile Valente here tackles ballads and show tunes, jazz numbers and swing with equal charm and aplomb: I Happen to Like New York — Lullaby of Broadway — Autumn in New York — Chinatown, My Chinatown — Something's Coming — Manhattan Serenade — Broadway — Sidewalks of New York — Take the "A" Train — Oh, Lawd, I'm on My Way. A first-class orchestral combination provides excellent support, while a mixed choir makes brief appearances without contributing much to the enterprise as a whole. (H.A.T.)

★ ★ ★

**TRICKS WITH HITS. The Liberty Studio Orchestra. Universal Record Club Stereo and Mono U-911.**

This is a perfectly respectable recording of popular tunes, nicely arranged, well played and recorded in excellent quality sound. However, I failed to find any trace of "tricks" to justify the title and the enthusiastic sleeve note. The 12 tracks include: Hello, Goodbye — Daydream Believer — It Must Be Him — Up-Up and Away — Massachusetts — Whiter Shade of Pale. If the selection of tunes appeal, the disc should please. (H.A.T.)



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**MOMENTS TO REMEMBER.** The DeAngelis Singers with Peter DeAngelis and his orchestra. Ampar (Festival) Stereo SML 932,950.

My teenage daughter summed up this disc very succinctly, when she said "It's a wonderful selection of songs—if only the singers were better." And that is exactly how it struck me. The DeAngelis singers are similar in style to the Ray Charles Singers, but not in the same class. Tunes include: All My Love — Kiss Me Goodbye — La-La-La — "Valley of the Dolls" Theme — Young Girl — Scarborough Fair — Moments to Remember. Sound quality and stereo are both excellent (H.A.T.)

**ALAN JONES SINGS.** Universal Record Club Stereo and mono U-898.

Although he must now be well into his sixties, Alan Jones, the idol of cinema goers of the thirties and forties, proves here that he is still a very fine singer. With excellent orchestral backing, he here delivers 10 tracks including: The Impossible Dream—Gianina Mia—Blue Velvet—Born Free — A Man and a Woman—Donkey's Serenade. Good entertainment, but mainly for those with nostalgic memories, I suggest. Excellent sound and stereo. (H.A.T.)

## Popular Jazz

**KID ORY FAVOURITES VOL. I** — Kid Ory's Creole Jazz Band. Good Time Jazz (RCA) Stereo S10041/1 (Also available in mono).

Interest: Revival Jazz (mid-1950s).

Performance: Enthusiastic, good quality session.

Quality: Bright recording.

Stereo: Adequate separation.

Even now, there is still considerable dispute among critics in their assessment of Kid Ory's recording sessions between 1944 and 1961.

In this context I only want to say that, in my view, Kid Ory's 1944/45 recordings with Mutt Carey were his finest from this period; and that Ory never adequately replaced Don Ewell on piano.

The tracks under review were recorded with nine others in June and July of 1956. The band included Alvin Alcorn, a competent trumpeter with a slight tendency to stilted phrasing; Phil Gomez, the Mexican clarinettist, whose work on these tracks was much better than has often been suggested; Cedric Haywood (piano) who sounds thoroughly ill at ease in this setting; and an enthusiastic and expert rhythm section of Julian Davidson (guitar), Wellman Braud (bass) and Minor Hall (drums).

Ory himself was in great form, rounding out the ensembles with his gutty tailgate and producing fresh and forceful solos on most of the tunes (which include mainly standards like "High Society," "Careless Love" and "Panama").

I enjoyed the exuberance and spirit which the band displayed. It could not be judged as a classic Ory session but this is an album which lovers of New Orleans jazz should make a point of hearing. The playing time is 43 minutes, which is good value for the modest price of \$3.95. (T.F.C.)

★ ★ ★

**SMASHING THIRDS** — Fats Waller. RCA Vintage Series Mono LPV-550.

Interest: Waller's Rhythm—1937.

Performance: Very welcome and enjoyable LP.

Quality: Superbly remastered.

This is the fourth RCA Vintage reissue devoted to Fats Waller — the others being "34/35," "Valentine Stomp" and "Fractious Fingering" — and it contains three piano solos from 1929 and thirteen tracks from 1937 by Fats Waller and His Rhythm.

Of the 1929 tracks, "Smashing Thirds" is one of his very finest piano

solos but the other two solos, "Waitin' At the End of the Road" and "Turn On The Heat" are pleasant enough but a little lightweight.

The overall quality of the Rhythm tracks is not quite as high as on "Valentine Stomp" (the best of the four albums), but there is still some excellent Waller.

My favourite tracks are "How Can I," "Sweet Heartache" and "She's Tall, She's Tan, She's Terrific," but this release is also notable for the inclusion of the 12in-78 instrumental version of "Honeysuckle Rose" and "Blue, Turning Grey Over You."

The key men in Waller's Rhythm, Al Casey, Gene Sedric and Herman Autrey—three underrated musicians—worked with him through the 1930s. While all three contribute first-rate solos on these tracks, Al Casey's rich guitar chordings and unpretentious solos are particularly outstanding.

Most readers will know pretty well what to expect on this record—some exuberant, swinging and humorous music with Waller's massive personality and remarkable talents dominating the proceedings.

RCA are to be commended for making these Vintage albums available in Australia at the bargain price of \$3.95. With a playing time of almost 50 minutes, this LP deserves the close attention of collectors. (T.F.C.)

★ ★ ★

**THE NEWBORN TOUCH** — The Phineas Newborn Trio. Contemporary (RCA) Stereo S3615.

Interest: Modern jazz piano.

Performance: A much improved Newborn.

Quality: Superbly recorded.

Stereo: Good separation, well balanced.

When Phineas Newborn first emerged on the modern jazz scene in the mid-1950s, his playing was technically brilliant but barren of constructive ideas. Despite the adulation of critics like Leonard Feather at that time ("Newborn is the greatest living pianist"), it looked as if he would lapse into obscurity, particularly in view of his emotional ill-health in the early 1960s.

However, on this, his third album for Contemporary (the other two being "A Word Of Piano" and "The Great Jazz Piano") his playing reveals a new logic and inventiveness, a control over his technique, which promises well for the future.

The idea behind the album was for Newborn to present his interpretations of 10 tunes by composers who had

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previously recorded them for Contemporary Records.

This worked surprisingly well and the outstanding tracks are "Groove-yard" by the late and very talented Carl Perkins, the waltz "Blue Daniel" by Frank Rosolino, "A Walkin' Thing" by Benny Carter, "Diane," the beautiful ballad by Art Pepper, and "Blessing" by Ornette Coleman.

It is rare for the normal run of pianists to sustain interest over two sides of a trio LP, but the variety of the material was undoubtedly of assistance to Newborn. In addition, he received sympathetic and accomplished support from Leroy Vinnegar (bass) and Frank Butler, one of the finest modern jazz drummers.

This album, which plays for 38 minutes and was recorded (superbly) in April, 1964, can safely be recommended to collectors of modern jazz piano — particularly at the budget price of \$3.95 (T.F.C.).

★ ★ ★

**HELLO LOUIS!** — **Bobby Hackett.**  
**Harmony (CBS). Stereo HAS 075**

Interest: Disneyland Dixieland.  
Performance: Excellent Hackett  
but . . .

Quality: Bright recording.

Stereo: Not well balanced.

This record is something of a mystery. Since it has been released on CBS' budget-priced Harmony label, I assume that it is a reissue. It is not, however, listed in the latest Schwann nor in the English catalogues. The personnel and recording date must, therefore, remain unknown for the present.

The basic idea of Hackett recording Louis Armstrong compositions is fitting. In the late 1930s Hackett was rather more a Beiderbecke man but his postwar playing has moved closer to Armstrong.

Hackett himself plays extreme well on this album but, with the exception of the trombonist (probably Marshall Brown) the rest of the group is unbelievably poor. The soprano saxophone player is quite the worst I have ever heard and the rhythm section of piano, tuba, banjo and drums is lumpy and unsympathetic. Hackett's sidemen sound to me like studio musicians reading their parts.

Despite the Armstrong compositions and Hackett's splendid form, then, this record must be counted a failure. The final straw for me was the conversion of "Big Butter and Egg Man" to "Butter and Egg Bossa Nova!" (T.F.C.)

★ ★ ★

**DOWN HERE ON THE GROUND—**  
**Wes Montgomery. A and M**  
**Records (Festival), Stereo SAML-932,897 (also available in mono).**

Interest: Possibly Montgomery's last album.

Performance: See text.

Quality: Well recorded.

Stereo: Normal balance and separation.

The late Wes Montgomery was, without doubt, the greatest postwar jazz guitarist. Unfortunately, he never really did himself full justice in the recording studio but his earlier albums for Riverside were by far his best sessions.

Since 1965, however, Montgomery's records (for Verve and then A and M Records) were aimed squarely — and

very successfully — at the popular market. But the qualities which had lifted him head and shoulders above his contemporaries — his remarkable and unusual technique, his distinctive tone, the feeling and warmth in his playing, his drive and originality — were dulled by commercial concessions.

On this album, Montgomery is backed by four strings, three woodwinds, and a rhythm section of Herbie Hancock, Ron Carter and Grady Tate. Don Sebesky's arrangements are pleasant enough but, to my mind, they serve no useful function. The overall effect is to lull rather than stimulate.

The material, too, is a little mixed. It includes Hoagy Carmichael's "Georgia On My Mind"; two film themes by Lalo Schifrin; two fairly good blues by Montgomery himself; a bossa nova by Joao Donato; and a couple of rather ordinary pop tunes. Only one track runs for more than four minutes and the total playing time of the 10 tracks is 31 minutes — a good measure of its commercial nature.

The music on this album is well played — but it hardly represents a suitable memorial for a very great musician. (T.F.C.).

★ ★ ★

**SATCHMO AT SYMPHONY HALL**

—**Louis Armstrong's All Stars.**  
**Calendar (Festival). Mono R66-452.**

Interest: Armstrong in Concert (1947).

Performance: Inconsistent but enjoyable.

Quality: Patchy "live" recording.

The concert by Louis Armstrong and his All Stars at Boston's Symphony Hall on November 30, 1947, was issued on American Decca (English Brunswick and then Ace of Hearts) on two L.P.s. For some reason, Festival have taken one side of each of these albums to produce this single volume for their budget-priced Calendar label.

At this time Louis was in his second prime and he had in the All-Stars a concert group which was geared to entertain the average concert audience. No personnel is listed on the sleeve-note but the group, in fact, comprised Barney Bigard (clarinet), Jack Teagarden (trombone), Dick Cary (piano), Arvell Shaw (bass) and Sid Catlett (drums).

The music was at times brash and a little light-hearted with the All-Stars rarely extending themselves.

Nevertheless, there is some enjoyable music, particularly on "Muskrat Ramble," "Black and Blue" (vocal by Armstrong) and "Royal Garden Blues." One of the problems with an All-Star line-up is that the sidemen tend to be over-featured. On this occasion "Stars Fell on Alabama," "Lover" and "Baby Won't You Please Come Home" spotlight Teagarden's relaxed trombone and singing; Bigard has "C Jam Blues" to himself; and Arvell Shaw and Big Sid Catlett are featured on "How High The Moon" and "Boff Boff" respectively, the former being one of the most tedious bass solos on record.

The tracks could, I think, have been better chosen from the available material but this is still an enjoyable enough album. The previous Calendar release, "The Best of Satchmo" (R66-344), however, is a much better buy (T.F.C.).



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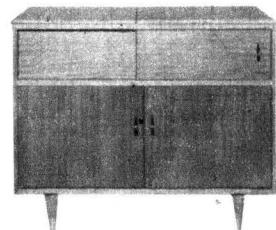
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## NEW EQUIPMENT CABINETS



MODEL 154

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New Player Platform model 175 is 16in x 14in x 3½in. Price \$7.50 for maple or walnut. Kit of parts \$4.00. Teak 50c extra. Perspex cover, 5in high, \$8.20 and \$1.50 extra if required hinged.

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# TRADE REVIEWS AND RELEASES

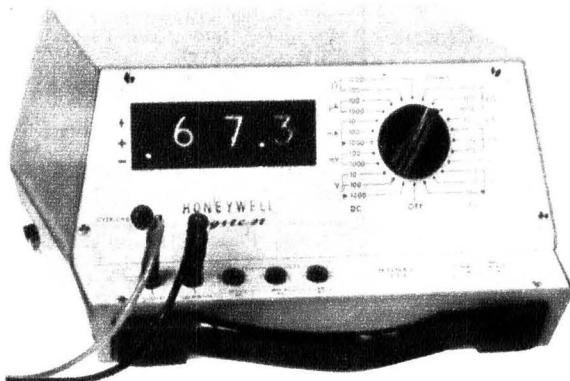
## Compact Digital Multimeter from Honeywell

Pictured is a recent addition to the Honeywell range of digital measuring instruments, the "Digitest 333" portable 3-digit multimeter. A compact low cost solid-state instrument which operates either from the mains or from internal batteries, it provides 23 measuring ranges covering direct voltage and current, alternating voltage and current, and resistance.

The Digitest 333 is manufactured by Schneider Radio-Television S.A., of Ivry, France, with whom Honeywell in the U.S.A. and Honeywell Pty. Ltd. in Australia and New Zealand have exclusive agreements for sales and service in the latter countries. Released in Europe early last year and in the U.S.A. at the beginning of this year, the instrument has al-

and 1A DC ranges, which each have individual "active" input jacks.

The Digitest is basically a digital voltmeter, the remaining ranges involving conversion of the measured quantities into corresponding DC voltages. Analog-to-digital conversion is performed using the ramp technique, in which is measured the time taken for an accurately-control-



*The Digitest 333 uses a 24 position selector switch with a minimum of auxiliary terminals and controls. It is a truly portable instrument.*

ready found extensive use in development and research situations, field and workshop servicing, and educational applications.

The physical size and weight of the Digitest make it well suited for use either in the field or in crowded bench situations — it measures only 9in x 7-7/8in x 5-1/8in, and weighs but 7 pounds. The attractively styled case is constructed from stout sheet metal, covered with heavy vinyl, and would appear well capable of withstanding the shocks and abuses which are more or less the inevitable fate of specifically portable instruments.

Readout display is by means of three side-viewing cold-cathode numerical indicator tubes, together with some five small neon lamps used for indication of decimal point, polarity and over-range. Optical filtering is used to provide improved display readability in conditions of high ambient illumination. An additional front-panel lamp is used to indicate potentially dangerous overload conditions.

The 23 measuring ranges provided by the instrument are selected by a single function switch, the 24th position of which is "off." There are five DC voltage ranges, covering from 100mV to 1000V full scale; five direct current ranges, from 100uA to 1A full scale; five resistance ranges, from 100 ohms to 1M full scale; four AC voltage ranges, from 300mV to 300V full scale, and four alternating current ranges, from 300uA to 300mA full scale. Two input jacks are used for all ranges except the 1000V DC, 300V AC

led voltage ramp waveform to reach the amplitude of the unknown voltage. In the interests of stability the Digitest actually uses two matched voltage ramps, a technique which also provides a delightfully straightforward means of automatic polarity detection and indication.

Resolution of the instrument on the DC ranges is 0.1% of full scale, while on the AC ranges the reduced full scale capacity raises this figure to 0.3%. Rated accuracy on the three highest DC vol-

tage ranges is 0.2%  $\pm$  1 LSD; on the resistance ranges it is 0.5%  $\pm$  1 LSD; on the resistance ranges it is 0.5%  $\pm$  1 LSD; on the direct current and AC voltage ranges, 1%  $\pm$  1 LSD, and on the alternating current ranges 1.5%  $\pm$  1 LSD. Response time on the DC functions is rated as less than 2 seconds, while that of the AC functions is less than 5 seconds. The common-mode rejection is rated at 90dB for 60Hz.

Screwdriver adjustments are provided on the front panel of the instrument for zero-setting and full-scale calibration of the basic voltmeter section. To facilitate the latter adjustment a jack on the left-hand side of the case provides a source of 9.995V, derived from the instrument's regulated power supply by means of a preset voltage divider.

A companion jack is also provided to allow checking of the internal batteries, which consist of 10 x 1.25V nickel-cadmium cells wired in series. The power supply circuitry is arranged so that the batteries are float-charged whenever the instrument is connected to the mains.

When tested in our laboratory, the sample Digitest gave a most impressive performance. It gave consistent and stable readings which were comfortably within the accuracy ratings quoted by the manufacturer, and proved a most convenient and flexible instrument to use in typical measurement situations. The zero and calibration stability appeared to be better than average for this class of instrument, and quite adequate for the intended applications.

The only aspect which we found slightly disappointing was the restriction of the AC function ranges to a useable full-scale capacity of around "300," in contrast with the full "999" capacity of the DC function ranges. No doubt there were good reasons for this limitation, quite possibly economical in origin, and it should be emphasised that full allowance for the restricted capacity has been made in the manufacturer's ratings and specifications. For the applications intended the restriction will very likely prove of only minor importance.

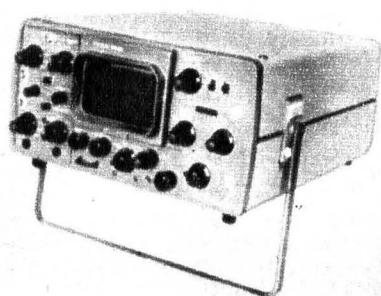
In short, then, the Digitest 333 appears to us to be a well-designed and flexible instrument, and one which is capable of a high order of performance. It should make a significant contribution to the adoption of digital instrumentation in general development and servicing applications, and not the least reason for this should be its high performance/cost ratio.

The price of the Digitest has recently been reduced to the attractive figure of \$420 plus tax (where applicable), a reduction which we understand has been brought about by reduced costs arising from an expanding production schedule. Further details regarding this and other Honeywell instruments may be obtained from Honeywell Pty. Ltd., Industrial Products Division, at 63 Ann Street, Surry Hills, N.S.W. 2010. (J.R.)

## Double-Beam Oscilloscope

S.E. Laboratories (Engineering) Ltd., of Middlesex, England, has just released a true double-beam oscilloscope, Type EM102, employing silicon and integrated devices with a choice of plug-in modular Y amplifiers. The instrument is said to be low in cost with high performance, and operates from either AC mains or batteries.

Plug-in units of bandwidth DC to 15MHz are available from current production. Additional modules of bandwidth DC to 30MHz including signal delay and also high-sensitivity versions of 10uV/cM at 500KHz bandwidth, are planned. Other main frame versions will be available. The instrument has time-base speeds from 200nS/cM to 1sec/cM, variable sweep delay from 0.1mS to 100mS,



and has the facility of differential measurements. It uses a split beam tube with 10KV PDA to give a bright display.

Inquiries should be addressed to E.M.I. (Australia) Ltd., P.O. Box 352, Haymarket, Sydney, N.S.W. 2000.

# GOLDRING MAGNETIC CARTRIDGES

Messrs. Goldring Engineering (A'sia) Pty. Ltd., have recently announced release on the Australian market of their new 800 series magnetic cartridges. Among other things, the manufacturers claim for the cartridges high compliance, low effective tip mass, extended frequency response and especially good separation between channels.

Current advertisements for the 800 series cartridges, representing Goldring's re-entry into the magnetic cartridge market are headlined by the phrase, "Chosen by the B.B.C. . . ."

Goldring describe the principle of operation as "free field" which is a method of inducing magnetism in a light metal tube with a permanent magnet mounted just above the removable stylus assembly. The tube is coupled to the stylus, reputedly keeping the moving mass to a quite low order and the system resonance to an amplitude and frequency where it will have a minimal effect on the reproduction.



The 800 series cartridge is very compact and weighs 8 grams. It has the usual half-inch mounting centres and is supplied with two mounting screws and a set of push-on lugs for connection in the headshell. The output terminals are clearly marked and colour-coded, so that there should be no problems about fitting the head into the kind of good quality arm with which it is intended to be used. In-built magnetic shielding inhibits hum pickup from stray fields.

The cartridge submitted to us for inspection and review is designated as type 800E, fitted with an elliptical stylus of which the respective radii are 0.0003 and 0.0008 in; the removable stylus assembly is grey. The other cartridge in the series, distinguished by a white stylus assembly, has a conical stylus with a radius of 0.0005 in.

The claimed performance of the 800E cartridge is as follows:

Frequency response ..... 10Hz-25KHz  
Separation at 1KHz ..... 25dB  
Compliance (static) ..  $30 \times 10^{-6}$  cm/dyne  
Sensitivity ..... 5mV at 5cm/sec  
Tracking weight ..... 0.75-2.0 grams

Packaged with the cartridge submitted was a frequency response curve on standard Brüel and Kjaer automatic plot paper, and a test data slip showing the output, balance and separation for the particular cartridge at 1KHz. The figures were: left channel 5.2mV, right channel 5.4mV and separation 27dB. The frequency response curve carried no indication as to which of the alternative dB scales applied, compounding the vagueness in the printed data, in which response is quoted again without dB limits. The curve, however, showed a virtually flat response to 6KHz, a rise of either 1½ or 3dB at 10KHz, a drop of either 1 or 2dB at 17KHz, recovery to reference at 20KHz and a sharp drop thereafter.

Initially, the cartridge was set up in an arm of average hi-fi quality for a listening test on music. We found that a playing weight of 1½ grams was desirable to ensure proper tracking of some heavily modulated grooves although, for most records, 1 gram was sufficient. Our initial impression was that the sound was very clean and with good separation between channels.

Frequency response and separation between channels was duly checked using the CBS STR-100 record and precision AC voltmeter, using a load of 47K. Tracking weight was set at 1 gram. The frequency response checked out at  $\pm 1$ dB from 30Hz to 10KHz in both channels; between 30Hz and 20Hz it was 2dB above the reference level. This is very good performance and explained the clean, well balanced sound. However, from 10KHz the response tapered gently down to about -13dB at 20KHz.

While a smoothly tapering response like this could largely be offset by judicious use of the tone control, we were puzzled by the lack of correspondence between our results and those suggested by both the curve with the cartridge and as indicated in at least one overseas review. We duly checked cable capacitance and the effect of load on the cartridge but without significant effect on the end result. Most likely explanation would seem to be that temperature and/or humidity has slightly increased damping, dropping the aforementioned rise at 10KHz to reference and producing a definite taper above that figure.

Separation between channels was very good at 30dB at 1KHz and never less than 18dB anywhere in the measured range. This is about the best performance in terms of separation we have measured to date. The waveform over the entire audio range was also commendably clean, a factor contributing to the very acceptable sound. On "square waves," as recorded on the CBS STR-110 record, the cartridge acquitted itself well, any tendency to ringing being well damped.

At 2 grams the cartridge tracked the +12dB track of the W & G 25/2434 test record quite comfortably. The output from the cartridge was close to that specified and, while quite low, did not present any problems as far as hum was concerned, due to the efficient shielding.

On the whole then, we must credit the cartridge with a performance which would do justice to a high quality system. Details of price and availability of this and the 800 cartridge can be obtained from Goldring Engineering (A'sia) Pty. Ltd., 443 Kent Street, Sydney or their interstate offices. (L.D.S.).

## TRADE CORRECTION

**JACOBY, MITCHELL and CO. PTY. LTD.** has advised that a cable is, in fact, available to permit direct video connection of the Sony CVC-2100ACE Video Camera to the CVM-51UETP Receiver/Monitor, contrary to the statement made in our review of these products in the August, 1968, issue (page 117). Although not sent to our laboratory for review, the cable is readily available as an optional extra for the camera.

**ZEPHYR PRODUCTS PTY. LTD.**, 70 Batesford Road, Chadwick, Vic. 3148, have pointed out that they are the Australian distributors for Cir-Kit self-adhesive copper laminate, and that Jacoby, Mitchell and Co. Pty. Ltd. are the N.S.W. agents.

## TRADE SUPPLIES AVAILABLE FROM INTERNATIONAL

### P.M.L. MICROPHONES

International Dynamics now has available a wide range of high quality dynamic microphones from Pearl Mikrofonlaboratorium of Sweden and the London Microphone Co.

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Two London microphones have also been released. The Model LM 100 is an omnidirectional dynamic unit with a response of 50-15,000 Hz. Another popular model is the LM 200, a dynamic cardioid microphone with balanced output and a response of 50-15,000 Hz. Discrimination at 180° eliminates unwanted background noise. Ask for copies of reviews from authoritative overseas magazines and for complete technical data.

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Motor: Completely sealed 12 pole synchronous type.

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Number of moving parts: 3 (rotor, platter and drive belt).

Ratio of mass: Turntable mass and drive mass are almost identical.

Price: \$39.50.

Write for complete details to the Australian Distributors.

### COMPAX CE-5000 SOLID STATE STEREO TUNER/AMPLIFIER, \$169

Power Output: 40 watts R.M.S. total (80 watts I.H.F.M. total).

20 watts R.M.S. per channel (40 watts I.H.F.M. per channel).

Frequency response: 20-20,000 Hz.  $\pm 2$  dB.

Harmonic distortion: Less than 1%.

Signal to noise: — 60 dB.

Input sensitivities: Magnetic pickup—3 mV.  
Crystal pickup—50 mV.  
Aux. input—150 mV.

Speaker impedance: 4-16 ohms.

Bass and treble controls: Each  $\pm 10$  dB. at 100 Hz. and 10 kHz. respectively.

Dimensions: 16½" x 10½" x 5½".

Tuner frequency range: 535 Kc. to 1605 Kc. Sens. 50 mV.

Tuner intermediate frequency: 455 Kc.

Features include scratch, loudness and rumble controls; the external cabinet is beautifully finished in selected teak veneers. The performance of this attractively priced stereo tuner/amplifier is quite outstanding. Price: \$169.

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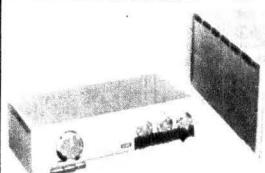
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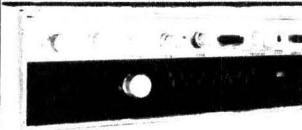
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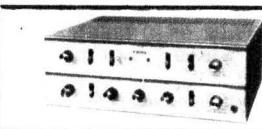
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## SANSUI AU70

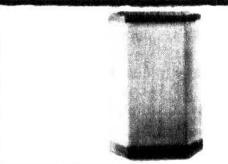
If it's a valve amplifier you prefer, then this is the one for you. Exquisite quality and a performance that will surprise you—25/25 W RMS.



## TRIO TK400

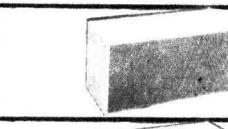
A top grade SOLID STATE amplifier at a down to earth price—32 W RMS per channel—Silicon transistors throughout 20-50,000 Hz at plus or minus 1db.

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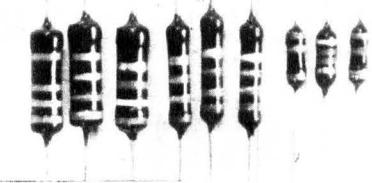
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SYDNEY. 29-1527

## CARBON FILM RESISTORS

The standard range of Beyschlag carbon film resistors (1/10 watt, 1/8 watt, 1/3 watt and  $\frac{1}{2}$  watt) is available from Standard Telephones and Cables Pty. Ltd., Moorebank Avenue, Liverpool, N.S.W. 2170.

The Beyschlag deposited carbon film resistors are very stable components, now manufactured in large quantities at low prices. The resistor body is made of a high quality non-porous ceramic with a very smooth surface. All values are made to very close tolerances. The carbon layer is deposited on the ceramic rods at closely controlled temperatures. Diamond cutting wheels cut a clean uniform spiral in the carbon layer while resistance is being measured; when the exact value is reached, the cutting stops automatically.

Five individual layers of lacquer, each followed by an oven baking, ensure maximum protection against environmental conditions. The enamel has an insulation

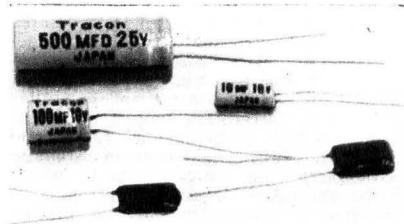


resistance of not less than 10,000 megohms, and will withstand approximately 1000V DC before breakdown. After enamelling, the resistors are colour coded and individually tested for tolerance and noise level. Resistors falling outside the limit are destroyed.

The temperature co-efficient of the Beyschlag carbon film resistors typically varies between  $2\frac{1}{2}$  and 8 per cent per 100°C (measured from 20°C to 120°C). Noise over a frequency range from 20Hz to 1MHz is typically less than 4uV per volt. Maximum resistance change for 1000 hours at 70°C is 1.5 per cent.

## TRACON CAPACITORS

Kit-Sets Aust. has been appointed Australian agent for Tracon polyester and electrolytic capacitors. It is stocking a full range of polyesters, from 3.3pF to 0.47uF (45 values) rated at 100V. The electrolytics are stocked with ratings of 10VW and 25VW in the following values:



5uF, 10uF, 25uF, 30uF, 50uF, 100uF, 200uF, 500uF and 1000uF.

As an introductory offer, Kit-Sets Aust. will supply a bulk pack comprising two each capacitors of the 45 values in the polyester range between 3.3pF and 0.47uF for \$6.80 post free; and a bulk pack comprising 40 electrolytics between 5uF and 1000uF, 10VW and 25VW, for \$6.95 post free.

Inquiries and orders should be addressed to Kit-Sets Aust., Box 176, P.O., Dee Why, N.S.W. 2099.

# AKAI M-9 FOUR-TRACK STEREO TAPE RECORDER

The latest model in the very successful Akai "M" series of stereo tape recorders, the M-9, has been made available for review by the importers, Maurice Chapman and Co. Pty. Ltd.

Like its predecessors, the M-9 is a four-track stereo machine incorporating the Akai patented cross-field bias system. The general layout of deck amplifiers and controls can be seen in the accompanying photograph. Finish is in the familiar brushed aluminium and black, while the case and lid are of wood construction, and covered in canvas-grained grey plastic material. Four operating speeds are available, 15ips, 7½ips, 3½ips and 1½ips. Maximum size of spools which can be accommodated is 7in. Since the machine is designed to operate in the vertical position, holding clips are provided for the spools. (Extra feet on the rear of the case allow the machine to be used in the horizontal position, should this be desired.)

While most of the controls are conventional, the M-9 does require some care on the part of the operator in setting up for the desired results. For example, the equalisation for the different operating speeds must be set manually by means of a three-position switch. Operating speed changes require setting of a switch and selection of tape drive capstans. (Should the user wish to use the machine at 15ips, it is also necessary to change the pinch roller.) Bass boost is applied by means of a rocker switch which applies a fixed (unspecified) amount of boost. Multiple recording technique (sound-on-sound) is possible, by means of a switch on the front panel. VU type meters are incorporated in each channel to monitor recording level.

The M-9 is supplied with a minimum of accessories, comprising an empty 7in spool, a 7in demonstration tape, an adapter kit for operation at 15ips, spare fuses, silicone oil and spare felt pad for the inbuilt tape cleaner, and instruction manual. No microphones or connecting leads are supplied, and must be purchased separately by the customer. Other optional accessories available are a head demagnetiser, telephone pick-up, tape eraser, stereo headphones, head cleaning kit and tape splicer.

The main operating controls for the deck are located below the take-up spool. The record/playback control has the usual safety interlock to prevent accidental erasure. A "pause" control is located alongside the fast forward/rewind lever. This can be operated any time manually, but automatically goes to the "off" position after using the fast forward/rewind control. A "start" button just below the "pause" control is used to set the recorder in operation again. The head housing is located under the feed spool. Attached to the first tape-guide spool is a tape cleaner. This has a small felt pad which is kept moistened with a few drops of silicone oil. It is brought into operation by pressing a small button at the left of the deck. After use, it is returned to the "park" position manually.

Internal speakers allow monitoring during record, and playback for checking recorded material, but, for high-quality sound reproduction, external speakers of good standard are essential. External speakers are connected through jacks located in a recessed panel on the right side of the case. When these jacks are used, the internal speakers are automatically disconnected. A muting switch on the front panel allows whatever speakers are in use to be silenced.

Recording can be undertaken from

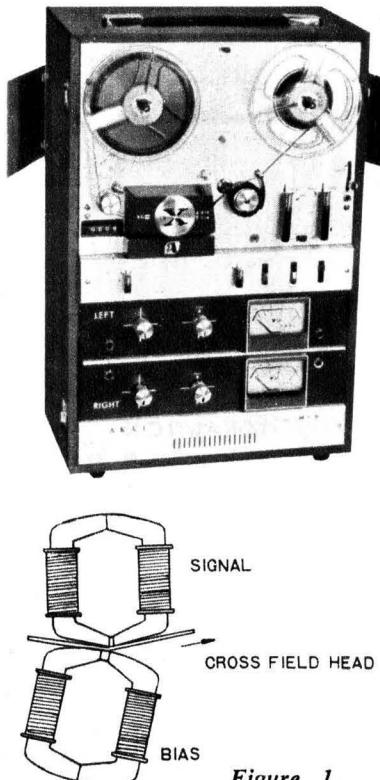


Figure 1.

microphones, using two inputs on the front panel; or from DIN and phone jack inputs located in a recessed panel on the right side of the machine. Line outputs are also provided in the five-pin DIN socket, or through separate phone jacks.

Before operating the machine in the "Record" mode, a certain amount of care is necessary to check that operating conditions are correct for the operating speed chosen, particularly in setting the equalisation switch, since this could easily be overlooked, and lead to unsatisfactory recordings. Having attended to these matters, recording is simple and straightforward, it being necessary only to press the "Safety Record" button and set the forward operating control to the "Record" position. Playback requires only the operation of the same control, set to the "Play" position.

During operation of the machine, we were impressed by the mechanical operation of the deck. All controls produced a smooth and positive response from the tape transport mechanism, with no sign of tape snatch or overrun. The tape counter was accurate, and we experienced no difficulty in returning to any point in the recorded material when the position had been previously noted. In the "Fast Forward" and "Rewind" positions, take-up is rapid (1,200ft in 90 seconds) and silent.

Before proceeding to measure frequency response, we first played through the demonstration tape provided, which was recorded for only part of the total tape, at a speed of 7½ips. For playback, we used a pair of Playmaster "Point-4" loud-

speaker systems. The quality of sound obtained was of a very high order, being smooth and round in the bass region, with no obvious peaks throughout the entire audible range, and with bright, clean treble.

Frequency response tests were made with a signal generator fed into the line input to record the range of frequencies shown in the specification as within  $\pm 3$ dB, then measured with a dB meter, using a dummy load across the loudspeaker terminals.

The specification showed a frequency response of 30Hz to 23KHz  $\pm 3$ dB for the 7½ips operating speed. The machine performed brilliantly at this speed to show a result well within the limits quoted. In fact, our measurements showed a variation of only 1dB over the entire range for the right channel, and 3dB for the left channel.

Tested at the slower speeds, however, the machine did not quite meet the claimed performance figures. At 3½ips, the makers claim 30Hz to 18KHz  $\pm 3$ dB. At the bass end, performance was entirely satisfactory, being 3dB down on reference at 30Hz, and response was substantially flat up to 12KHz, where roll-off began. Using a moderate amount of treble boost, we were able to sustain response to within  $\pm 3$ dB up to 15KHz in both channels. Although outside the specification, we regard this figure as very good for this operating speed.

Similarly, at the 1½ips speed, we could not quite match the manufacturer's claim of 30-9,000Hz  $\pm 3$ dB, but using a discreet amount of treble boost we were able to obtain a response of  $\pm 3$ dB from 30-8,000Hz. Here again, the result is good, for this low speed.

During our tests there was no noticeable wow or flutter in the music tracks played, and we have no reason to doubt the maker's claimed specification of less than 0.15 per cent at 7½ips.

The makers say that the superior frequency response of the Akai M series of recorders is due to the patented cross-field heads used. With this system, the bias signal is applied to the tape from a separate head, placed on the opposite side of the tape to the signal head (see figure 1). The theory of the operating principle is that when bias is applied by mixing it with the record signal, as is done with most other recorders, the record signal is unduly influenced by the high flux of the bias signal, and the higher frequencies are attenuated. This attenuation is avoided when the cross-field system is used.

Power output is quoted as 15W undistorted per channel (presumably RMS), signal to noise ratio as better than 50dB, and wow and flutter as 0.15% RMS at 7½ips, 0.25% at 3½ips and 0.35% at 1½ips. No figures are given anywhere in the specification for the 15ips operating speed. It is unlikely that this speed will be used by other than professional recordists.

To sum up, we find the M-9 to be a machine of exceptional performance, providing facilities for making high-quality stereo tapes in the domestic context, but in view of certain features of its operating procedure, more suited to the experienced tape recordist who uses his machine consistently rather than for the casual user. It should be noted that no provision is made for using the audio section of the M-9 as an amplifier for playing discs.

Retail price of the M-9 is \$664. Information regarding availability, or any other details required, can be obtained from Maurice Chapman and Co. Pty. Ltd., Chapman House, 210 Clarence Street, Sydney, 2000. (H.A.T.)

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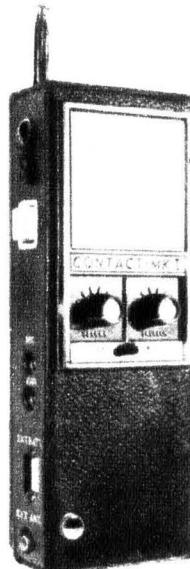
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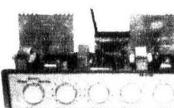
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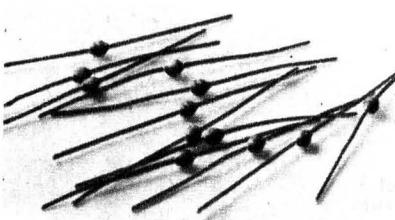
## TRANSIENT PROTECTED RECTIFIERS

The General Electric Co. has developed a series of transient-voltage protected silicon rectifiers, the A14 series, which can dissipate up to 1,000 watts in the reverse direction without damage. Due to an inherent low ohmic resistance of the package, the device can withstand current surges up to 100 amps.

The pellet of the A14 series of rectifiers is securely sandwiched between two heavy thermally matched slugs. These slugs provide rugged mechanical support for the pellet and draw heat away from it out to the high conductivity copper alloy leads. There are no S springs or whisker contacts to fail or to increase the thermal resistance.

When a transient reverse voltage appears across the rectifier, its PN junction goes into controlled avalanche breakdown, a non-destructive operating mode. The reverse power is distributed uniformly and safely throughout the bulk of the pellet and not localised at the perimeter. Use of controlled resistivity silicon metal for the pellet ensures that non-destructive transient-protection occurs always at a lower voltage than surface breakdown.

The A14 rectifiers have reverse voltage maximum ratings from 200 to 1000 volts. The average forward current rating is 1.0 amp, with a peak surge forward current rating of 65 amps (8.3mS half sine wave, no load) and 100 amps (1.0mS half sine wave, no load). Maximum avalanche voltage is 1600 volts. Peak non-repetitive reverse power rating is 1000 watts for a 20uS half sine wave, and about 40 watts for a 10mS half sine wave.



The marking band on these General Electric A14 rectifiers appears at the cathode end.

Typical applications for the A14 rectifiers include general purpose power supplies, time delay circuits, power logic circuits, arc suppression and SCR trigger circuits. Examples of prices are: 1N5060 (400V member of the series) 71c each plus tax for 1.9; 1N5062 (800V) \$1.42 each plus tax for 1.9. For further information write to Australian General Electric Pty. Ltd., 103 York Street, Sydney, 2000, or 552 Lonsdale Street, Melbourne, 3000.

## AVO MODULAR DIGITAL SYSTEM

An entirely new Avo Digital System, comprising a main display unit and a range of plug-in modules, has been introduced by Avo Ltd., of Dover, Kent, England.

The modular system provides an economic means of measuring a large number of electrical parameters which could otherwise only be measured with a number of separate instruments. The first stage is a DC multimeter with 45 ranges. When used with an optional AC/DC converter, the system provides 75 ranges of AC and DC measurement. Additional plug-in units will include a 20MHz timer/counter and low frequency signal generator. Print-out facilities are available from a 50-way socket at the rear.

Integrated circuits are used in conjunction with discrete components in the construction. A four digit neon display and associated circuitry enables the

measured value to be presented in digital form, as well as automatic indication of the polarity and overranging. The decimal point positioning is automatic when switching ranges.

With the multimeter module, the Avo System functions as an integrating digital multimeter for DC voltage, current and resistance measurements, which can be used in place of the more elaborate instruments otherwise used. DC voltage measurement accuracy is 0.05 per cent of indication,  $\pm 0.05$  per cent of full range value. An optional AC converter printed circuit is available which can be plugged into the multimeter module to provide the same measuring capabilities on AC as on DC, with an accuracy of 0.2% of the indicated value,  $\pm 0.1$  per cent of full range measurements. A built-in Weston reference cell enables the calibration to be checked and restored to its initial accuracy at any time, and a divide-by-two and divide-by-four facility improves reading accuracy below a half and a quarter full range.

The Australian agents for Avo Ltd. are Electrical Equipment of Australia Ltd., Box 4619, G.P.O., Sydney, 2001.



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(see Full Page Advertisement this issue Page 112.)

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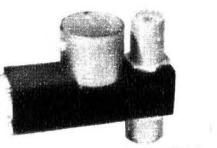
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# TRADE RELEASES-IN BRIEF

**PHILIPS ELECTRICAL PTY. LTD.** has announced a transistorised measuring panel, type PW1360, for use with X-ray diffractometers and spectrometers. Available in two versions, the new panel covers the entire range of Philips analytical X-ray equipment, and is said to improve the usefulness of this equipment by simplifying reading and recording. A dual high voltage power supply serves up to four pulse detectors simultaneously. An integrated timer and counter unit, with separate circuits but a shared display, incorporates its own low voltage supply. A pulse amplitude analyser with a linear amplifier is equipped to operate as an integral or as a differential discriminator. A choice of measuring methods is offered—either strip chart, preset time or preset count—and a large digital in-line display simplifies reading.

Further information may be obtained from the Scientific and Industrial Division, Philips Electrical Pty. Ltd., 69-79 Clarence Street, Sydney, 2000.

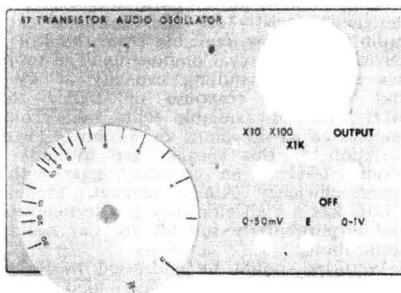
**ROLA DIVISION** of Plessey Pacific has developed a market in South Africa for key components used in the manufacture of refrigeration and air-conditioning equipment. The components are vacuum encapsulated solenoid coils, used mainly for defrosting purposes. To date, more than 20,000 coils have been ordered by one of the largest firms in the domestic refrigeration field in South Africa.

**RCA OF AUSTRALIA PTY. LTD.** has announced a new line of gas laser systems designed to meet the needs of industrial laboratories and electronic equipment manufacturers. The new lasers are continuous-wave argon laser (claimed to be the world's smallest), a pulsed argon laser, a 400mW continuous-wave krypton system, and a 5mW neon system. RCA is also offering a variety of argon, krypton and neon tubes to manufacturers who prefer to design their own laser systems. Additional technical information is available from the company at 11 Khartoum Road, North Ryde, N.S.W. 2113.

**FERRIS BROTHERS PTY. LTD.** has released model 199 push-button car radio, suitable for 12-volt positive and negative earthed vehicles, mounting either in-dash or under-dash as required. Seven transistors are used in the circuit which includes a tuned RF stage and two IF stages. There is provision for fitting a tape player via a 5-pin socket without removing the set from the car. The power output is 3

## PANEL AND DIAL

Heating Systems Pty. Ltd. has sent samples of a front panel and dial for use in the construction of the Transistor Audio Oscillator described in our December, 1967, issue. Both items are brushed aluminium finish with black engraved markings. These items are available through normal trade channels, or direct from the makers, at 24 O'Riordan Street, Mascot, N.S.W. 2020.



watts maximum. The receiver draws 650mA (including dial lamp) for 12 volts input at zero signal. The receiver alone retails for \$74.25 (including sales tax) (\$94 complete with speaker kit, dash fitting and car aerial). Inquiries to the company at 752 Pittwater Road, Brookvale, N.S.W. 2100.

**SPRAGUE ELECTRIC CO.**, of the U.S.A., has announced the series SE8000 and NE8000 high-speed low-power DTL/TTL unicircuit logic integrated circuits

providing high DC noise margins. A number of large functional arrays for counting and storage applications are also included. All elements are specified to be compatible. Inquiries to the Australian agents, D. R. Johnston and Co. Pty. Ltd., Stanhill, 33 Queens Road, Melbourne, Vic. 3004.

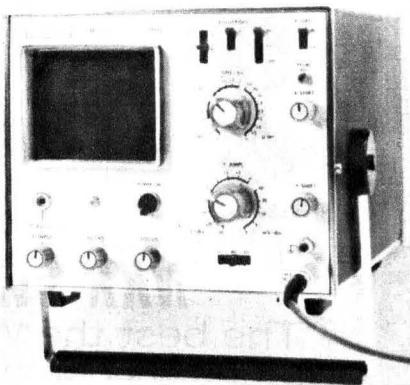
**RUTHERFORD ELECTRONICS PTY. LTD.** is marketing a range of Nutron wire-wound trimming potentiometers claimed to feature utmost reliability and stability. These components have been approved for use in equipment manufactured for the P.M.G.'s Department. For further details contact the company at 833 Doncaster Road, Doncaster 3108.

## PHILIPS PORTABLE OSCILLOSCOPE

A new portable oscilloscope available from Philips Electrical Pty. Ltd. operates from low voltage batteries and uses solid-state components in modular construction.

The Philips PM 3200 oscilloscope has a DC to 10MHz bandwidth (10Hz to 10MHz for AC) with a calibrated voltage range of 2mV to 50V per division. Accuracy is  $\pm 3$  per cent. The design makes full use of semiconductor active circuit elements, and Philips say that instability, noise and drift are virtually non-existent (no screwdriver adjustment for drift is provided, as this is considered to be unnecessary). Attenuator DC balancing is automatic, so no control is provided for this function.

Other performance details are: Time base speed variable from 0.1uS division to 0.5S/division in 21 calibrated steps; accuracy  $\pm 5$  per cent; high sweep speeds employed in preference to horizontal magnification, giving a much brighter trace at fast writing speeds; automatic triggering, trigger level being derived from the signal and can be selected from mean or peak values, with HF reject available for the latter; choice of positive or negative slope; internal, external or mains frequency source, preselected by switches; built-in time base stability which is maintained over a frequency range far exceeding bandwidth; dimensions 13in x 8.3in x 6.8in; usable screen area 2.37in x 2.95in;



operates from mains supply via 24V DC power pack, or from batteries.

Further information on the oscilloscope can be obtained from the Scientific and Industrial Equipment Division, Philips Electrical Pty. Ltd., Box 2703, G.P.O., Sydney, 2001.

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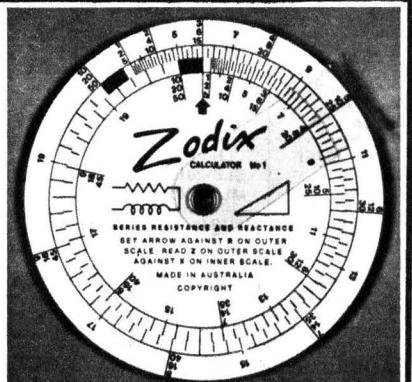
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	S-116	DPDT	2A 250V A/C	ON-ON
	S-2B	SPDT	5A 250V A/C	ON-ON
	S-305	SPDT	6A 250V A/C	ON-MOM ON
	S-6A	DPDT	10A 250V A/C	ON-ON
	S-533	DPDT	15A 250V A/C	ON-OFF-ON
Push Button Switch	SB-265	SPST	3A 250V A/C	PUSH-ON-PUSH OFF
	SB-61A	DPDT	5A 250V A/C	ON-MOM ON
	SB-25	DPDT	9A 250V A/C	PUSH ON-PUSH ON
See Saw Switch	SW-3511	SPST	1.5A 250V A/C	ON-OFF
	SW-3116	DPDT	2A 250V A/C	ON-ON
	SW-3006	DPDT	10A 250V A/C	ON-ON
Lamplighted <sup>†</sup> Switches	CLB-2085	DPDT	3A 250V A/C	PUSH ON-PUSH ON
	CLB-2011	SPDT	2A 250V A/C	ON-MOM ON
	MLB-2085	DPDT	3A 250V A/C	PUSH ON-PUSH ON
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†These style of push buttons are for panel mounting and feature a range of dual colours, the push button being a different colour to its panel surround.

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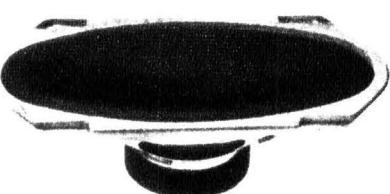
AMALGAMATED VALVE CO. PTY. LTD. has added the following devices to its range of components: AS147, AS148, and AS149 NPN silicon planar epitaxial transistors for general purpose use in audio and switching circuits; AS204, AS205, AS208, and AS209 NPN silicon planar epitaxial transistors for audio and general purpose applications; 17ERP4 directly viewed rectangular glass picture tube employing 114 degree magnetic deflection and low voltage electrostatic focus. For details write to the company at 348 Victoria Road, Rydalmere, N.S.W. 2116.

AUSTRALIAN GENERAL ELECTRIC PTY. LTD., has introduced the PA424 zero voltage switch. This is a monolithic integrated circuit that combines the functions of voltage level detector and trigger on a single chip. It is designed to sense a voltage differential and provide a trigger pulse capable of firing a thyristor at the line voltage zero crossing. The main advantage claimed for zero switching as opposed to phase control is that when controlling a resistive load the generation of radio frequency interference is minimised. The PA424 sells for \$2.66 each in lots of 100. Enquiries to the company at 103 York Street, Sydney, N.S.W. 2000.

ELMEASCO INSTRUMENTS PTY. LTD., has been appointed sole Australasian representative for the modular products manufactured by Fairchild Controls of California, U.S.A. These include a comprehensive range of discrete component operational amplifiers ranging from low-cost general-purpose types through to economically priced high-performance units. They are available in a number of case styles and may be wired directly into equipment or used in conjunction with mating sockets. Small quantities are available ex-stock in Australia. For further details contact Elmeasco Instruments Pty. Ltd., 41 Carter Road, Brookvale, N.S.W. 2100.

HONEYWELL PTY. LTD. has announced that it will market in Australia a family of low-cost magnetic-tape recording devices, designed "Keytape." These units enable information to be transcribed from source documents directly on to seven- or nine-channel half-inch magnetic tape. The family includes a standard Keytape recorder, an adding machine unit (to which may be added a check digit entry capability), pooler units, and special communications units. Inquiries to the company at 63 Ann Street, Surry Hills, N.S.W. 2010.

## NEW ROLA SPEAKER



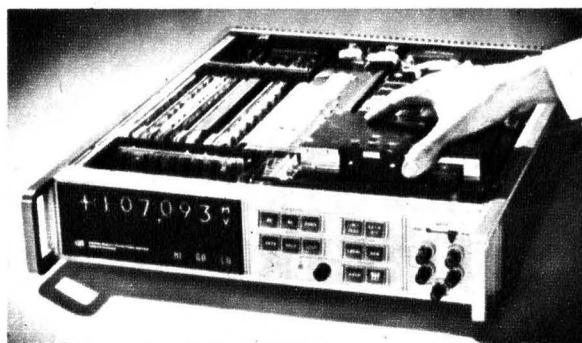
A new 7in x 3in elliptical loudspeaker, designed specially for television and car radio use is now available from the Rola Division of Plessey Components. The unit has a power handling capacity of 4W and frequency response of 100Hz to 6kHz, and is available with voice coil impedance of 15 ohms or 8 ohms. Two variations of this speaker are available. Model 7-3C is an economy type with lower efficiency Alnico magnet. Model C7-3L has a high efficiency ferrite magnet and is particularly suitable for car radio applications.

Inquiries should be addressed to Rola Division, The Boulevard, Richmond, Vic. 3121.

## DIGITAL MULTI-FUNCTION METER

Hewlett - Packard has introduced a new Digital Multi-function Meter, model 3450A. The basic instrument is an integrating digital voltmeter with five DC voltage ranges from 100mV full scale to 1000V, and with high accuracy. Readout is with five digits, plus a sixth for 20 per cent over-ranging on all ranges. Maximum sensitivity on the lowest range is 1uV. Two isolated inputs contribute to greater measurement flexibility and ratio measurements can be made on floating voltages. With optional plug-in modules, it can measure resistances and AC voltages (true RMS response to 1MHz) and ratios of AC voltages and resistances.

Equipped with other plug-in options, the meter can perform hi-go-lo limit tests on any function including ratios. The



*Adding a plug-in module to the Hewlett-Packard digital multi-function meter to give true RMS AC measurements.*

limit tests not only show whether the measured quantity falls within or outside pre-selected limits, but also give a numerical indication of the measured quantity at no sacrifice in measurement speed. Inquiries to Hewlett-Packard Australia Pty. Ltd., 22-26 Weir Street, Glen Iris, Vic. 3146.

**E.M.I. ELECTRONICS LTD.**, Hayes, Middlesex, England, has released a new one-inch electrostatic vidicon, type 9745. It uses a standard 1in vidicon envelope with a 14-pin base and can readily be used in cameras of diameter less than 1½ inches. The tube has a 0.6W heater and can be driven from solid-state deflection circuits. It is claimed to have an exceptional performance, particularly with regard to corner resolution and geometry. Inquiries to E.M.I. (Australia) Ltd., P.O. Box 352, Haymarket, N.S.W. 2000.

**DYNAMCO ELECTRONICS PTY. LTD.** announces a new generation of incremental tape recorders, manufactured by the Kennedy Company. High performance and low cost was the objective of this new range, which use integrated circuits. The model 1600 is said to offer all the performance features of IBM compatible recording. Inquiries to Dynamco at 90 Alexander Street, Crown Nest, N.S.W. 2065.

**FORSLUND ENGINEERING**, Petaluma, California, a leading American manufacturer of electronic circuit printers is to market six models in Australia through Frazar and Hansen Ltd., a worldwide export firm. The Forslund line includes two manual and two automatic circuit printers, a cermet printer and a completely automatic microprinter. The microprinter produces printed circuits on ceramic substrates and cermets at a production rate of 3,200 printed parts per hour, with a registration accuracy of .0005in. Inquiries to Frazer and Hansen Ltd., 150 California Street, San Francisco, California 94111, U.S.A.

**DUCON DIVISION** of Plessey Components will continue to market in Australia products made previously by the Electroluminescent Panel Production Unit of the Plessey Co. Ltd. (U.K.). Recently, the unit was acquired by F. W. Hopwood Developments Ltd., of Nottingham. Electroluminescence is a solid-state form of display lighting with the inherent reliability of solid-state devices. Alpha-numeric tiles for alphabetic and digital readout are available in numerous colours. Further information is available from the Professional Components Department, Ducon Division, Plessey Components Group, P.O. Box 2, Villawood, N.S.W. 2063.

**KLARION ENTERPRISES PTY. LTD.** has been appointed Australian agents for the range of high-speed tape duplicators manufactured by Otari Electric Co. Ltd., of Tokyo, Japan. Otari duplicators cover all tape formats and all machines are available either with dual capstan or single capstan drive and plug-in interchangeable pre-aligned head blocks to suit different tape formats. For example, the same duplicator can be used to manufacture 1in x 8 track tapes and 1in x 4 track tapes. As well as duplicators, Otari manufactures tape copy checking machines and tape winding machines to suit either 1in or 0.15in tapes. Inquiries to Klarion Enterprises Pty. Ltd., 321 William Street, Melbourne, 3000.

**RAM ELECTRONICS PTY. LTD.** has released a complete security protection system which sells for under \$100. The Gardell system operates from batteries and is designed for shops, offices and homes. A siren sounds in cases of illegal entry and outbreak of fire. Particular attention has been paid to reliable components (magnetic reed switches, etc.) to avoid the possibility of false alarms. A 10-page illustrated installation directory is supplied so that the purchaser can carry out his own installation or call in a contractor. Inquiries to the company at Box 3252, G.P.O., Sydney, 2001.

**BARNES ENGINEERING CO.**, of the U.S.A., has developed a passive infrared intrusion detector capable of detecting personnel at ranges of up to 1000ft and vehicles at over 2500ft. Designated the model 19-102, it provides an audio and/or visual alarm when a target whose temperature contrast to background is as little as 1°C, enters the detector's field of view. For further information contact the Australian agents, Rutherford Electronics Pty. Ltd., 833 Doncaster Road, Doncaster, Vic. 3108.

**AUSTRALIAN GENERAL ELECTRIC PTY. LTD.** has announced increased ratings for the popular C106 series of thyristors, with no price increase. The RMS current rating is increased from 2A to 4A; the peak forward current from 25A to 75A; and the peak surge current from 15A to 20A. Inquiries to the company at 103 York Street, Sydney, N.S.W. 2000.

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# TECHNICAL BOOKS AND PUBLICATIONS

## Understanding SCR's

**UNDERSTANDING SILICON - CONTROLLED RECTIFIERS**, by Saul Heller. Stiff paper cover, 134 pages, 8½in x 5½in, illustrated by line drawings and circuits. Published 1968 by Hayden Book Co. Inc., New York. Australian price, \$4.40.

In his introduction, author Saul Heller points out that silicon-controlled rectifiers were the subject of a modest paper presented to the American I.R.E. in September, 1956, by four engineers of the Bell Telephone Laboratories. Practical devices were developed by the General Electric Company in 1957, with just a few sales in 1958. Now, 10 years later, the SCR market represents an annual turnover of about \$50 million and is still rising. The devices themselves range in size from tiny units selling for less than a dollar to others worth hundreds of dollars apiece, with Britain producing one unit rated at 850V and 2,000A.

This new book sets out to acquaint the reader with this important class of device. Starting right back with molecules, atoms and electrons, it heads into the realm of conductors, insulators, semi-conductors, covalence bonds and crystalline structure. From here, it follows a natural course into impurities, doping, junctions, diodes and transistors. Specimen reading indicates a systematic, easy-to-read presentation, which is as it should be from an author who is an instructor at the Vorhees Technical Institute.

Having provided a suitable foundation, the author goes on in chapter two to explain the basic operation of SCRs. This is followed by a chapter on triggering, dealing with accidental or unwanted triggering, then deliberate triggering using resistance circuits, transistors, SCRs, unijunctions, phase sensitive circuitry and saturable reactors. Turn-off methods are covered in chapter four.

The next section covers "The Family Of SCRs," followed by a section on SCR applications, including light controls, proximity switches and other such devices. Phase-controlled devices come in for special attention, as do "Inverters, Choppers And Cyclochoppers."

The final chapter deals with SCR characteristics and ratings.

This is a book which will have an obvious appeal to students and advanced hobbyists, to electronic technicians, who must sooner or later come face to face with SCRs, and to electricians for the same reason. Our review copy came from Feffer and Simons, Inc., 122 Castlereagh Street, Sydney, 2000 (W.N.W.).

## Electronic organs

**ELECTRONIC MUSICAL INSTRUMENTS**. Richard H. Dorf. 3rd Edition. Published 1968 by Radiofile, 43 West 61st Street, New York. Hard covers, 393 pages, 9in x 6in, freely illustrated by photographs, diagrams and circuits. Australian price, \$10 post paid.

Richard H. Dorf will need no introduction to anyone who has done any browsing at all through the literature of electronic organs. Over and above his many magazine articles and books on the Schober organs produced by his own company, he has published two previous editions under this present title—one in 1955 and one in 1958.

However, in the preface, he stresses that this third edition is not just a facelifted version of the other two; rather is it a complete rewrite, leading into a discussion of the electronic organs which are currently in production for the American market.

The first eight chapters in the book deal in a general way with electronic organs and related techniques. The headings are: Elements Of Music—What An Organ Is—Tone Generators—Keying And Coupling — Tone Colouring — Special Effects And Equipment—Sound Production And Reverberation — Tuning And Servicing. The ground covered in these chapters will be familiar enough to those who have studied the literature of electronic organs, although there is value in having so much in one place. It will be a veritable goldmine of background information for those who are newcomers to the field.

The author has sought to avoid terminology which might impress—but equally confuse—non-specialist readers; at the same time, he has assumed that the reader will have a working familiarity with electronic theory. If you can read a journal like "Electronics Australia," you will be able to cope with the language of Dorf's new book.

And, speaking of language, the writing contains an obvious element of non-formal but refreshing humour and first person opinion, which he is certainly well qualified to offer. In fact, Richard Dorf displays a certain G. A. Brigg-ish quality.

The second portion of the book deals with organs produced by particular manufacturers. Space prohibits any idea of covering all models in detail but the author seeks to communicate the techniques which individual manufacturers appear to have favoured, as evidenced by a discussion of selected models from their range. All this is freely illustrated by relevant circuit segments. The manufacturers specifically featured are: Baldwin—Schober—Thomas—Lowrey—Gulbransen—Wurlitzer—Seeburg—Hammond—Rodgers—Allen—Conn.

All told, this must rate as a "must" book for all who are looking for—or can use—up-to-date background reading on electronic organs. The book is available ONLY from the Australasian distributors and ONLY by mail order: Schober Organs (Australia), 124 Livingstone Avenue, Pymble, N.S.W. 2073. As mentioned earlier, the price is \$10 post paid. (W.N.W.)

## Schober organs

**HOW SCHOBER ORGANS WORK**, 4th Edition. By Richard H. Dorf. Paper cover, 71 pages, 8½in x 5½in, illustrated by photographs, diagrams and circuits. Published 1966 by the Schober Organ Corporation, 43 West 61st St, New York

Earlier editions of this book will be known to most readers interested in electronic organs—small paper covered books which explain design principles of Schober organs, along with a useful amount of actual circuitry. This latest edition starts with a chapter on basic principles including the oscillator/divider generator system, "staircasing" of square waves to produce a full array of harmonics, formant filtering and phase-type vibrato.

Then follow individual chapters on four current models which are offered for home construction, using complete Scho-

ber kits—the Recital Organ, the Theatre Organ and two less expensive models, the Consolette II and the Spinet. The first three use transistors throughout, the last a neon divider system which has nevertheless proved to be extremely reliable.

Remaining chapters deal with amplifiers and loudspeaker systems, the Schober Reverberata unit, the Schober Percussion Group and the Mixer-Compressor Unit—the last named a collection of audio circuitry which helps to reconcile the natural dynamic range of an organ to the tolerance limits of a home.

In general, the information in the book parallels the Schober chapter in "Electronic Musical Instruments" reviewed elsewhere. But it is rather more detailed in this small book and it is well worth having as well, for its modest price. "How Schober Organs Work" is available ONLY from Schober Organs (Australia), 124 Livingstone Avenue, Pymble, N.S.W. 2073, and ONLY by mail order. Price is 50c post paid. (W.N.W.)

## Valves, transistors

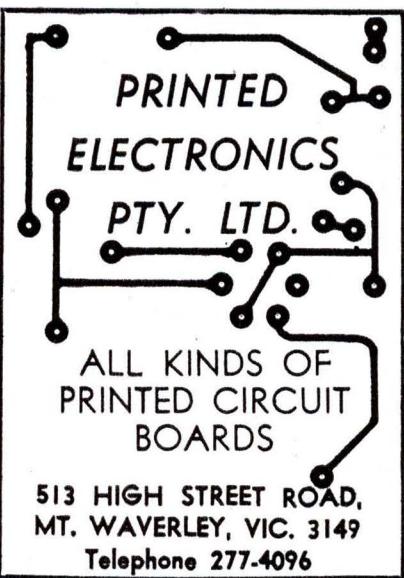
**HANDBOOK, VOLUME 1, ELECTRONIC TUBES**, 12th edition, July, 1966. Soft covers, 432 pages.

**HANDBOOK, VOLUME 2, SEMICONDUCTORS**, 6th edition, August, 1966. Soft covers, 264 pages. Published by De Mulderkring N.V., Bussum, Netherlands. No prices quoted.

The principal data is given for a large number of European and American valves and transistors, as well as cathode-ray tubes for television and oscilloscopes. The data is arranged in such a way that all relevant characteristics and connections for a given type can be read immediately. Basic circuit diagrams are given for a number of valve and transistor types, the valve circuits including typical currents and voltages.

The valve data handbook is arranged under eight main headings, marked with a coloured band, as follows: white—thyatrons; orange—diodes; green—triodes; yellow—tetrodes and pentodes; red—output tubes; grey—frequency converters; brown—combination tubes (triode-pentodes, etc.); purple—cathode-ray tubes. A comparative table has been included after each section showing types which are either completely identical or which differ only in filament voltage, filament current, or have a different base.

The basic transistor circuit diagrams in the semiconductor handbook are divided into groups, each being marked by a different coloured band, as follows: green—small signal AF amplifiers; yellow—RF



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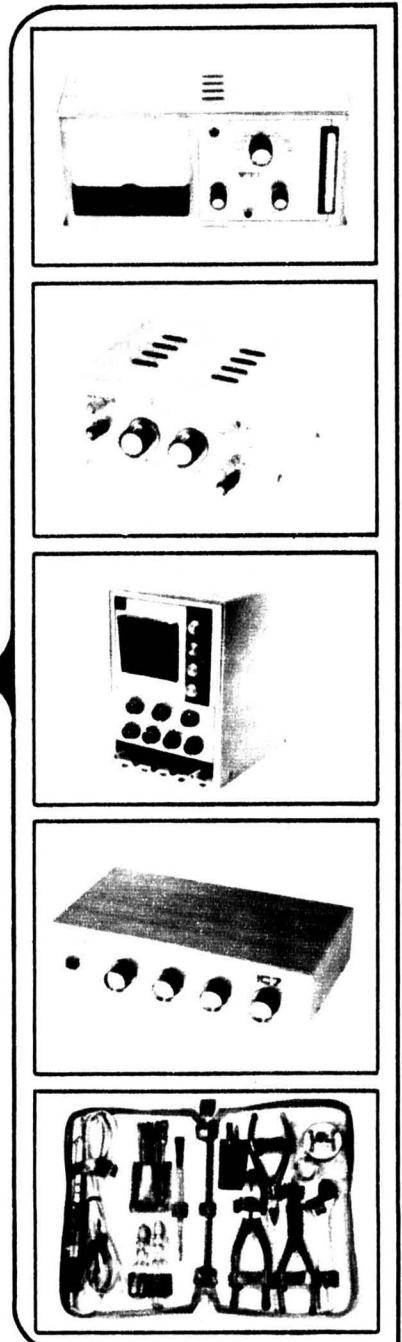
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and IF amplifiers; red—AF power amplifiers; grey—frequency changers. Essential transistor characteristics are listed in a section banded blue, while data for diodes is listed in a section banded orange. Transistor equivalents are listed at the end of the transistor characteristic section, although no indication is given as to whether these are exact or near equivalents.

One or two familiar types are missing—such as the 6AN7 valve and the BZY88 zeners—but nevertheless the information is so presented that the handbooks should prove of value to anyone who is using electron devices regularly. They provide answers to the oft-asked question—what can replace this valve or that transistor?—and therefore will be of assistance to those handling other than well-known, routine equipment.

Our review copies were provided by H. W. C. Blyth and Co., 3 Kerferd Street, East Malvern, Vic. 3145. It is expected that copies should be available at all leading technical booksellers. (J.H.)

## Oscilloscopes

**WORKING WITH THE OSCILLOSCOPE**, by Albert C. W. Saunders. Stiff paper cover, 104 pages, 11½ x 8½ in, well illustrated by pictorial diagrams. Gernsback Library series No. 472; published by TAB Books, Blue Ridge Summit, PA. 17214, U.S.A. -

If there are any readers on the lookout for a book which can teach them the ins and outs of oscilloscopes, this could be the book they are looking for. Designed for use by students, it goes through the subject in a carefully planned, systematic way with the successive lessons (not chapters) presented in black, easy-to-read type and bold diagrams on full quarto-sized pages.

Lessons 1 to 5 respectively deal with The Oscilloscope — Oscillographic Patterns — Time Base Generators — Vacuum Tube Time Base Generators — Vertical Deflection Amplifiers.

Following this study of the instrument itself, which occupies some 30 pages, are 26 "Projects," which are practical study lessons intended to be followed through with an actual oscilloscope to hand. However, such is the clarity of the drawings that the student could gain considerable value from the text alone.

The initial projects are quite simple ones, being aimed at nothing more than gaining experience with the adjustment of operating controls, an understanding and appreciation of linearity, trace amplitude, etc. But the projects increase gradually in scope to take in voltage measurement, phase relationships, the use of square waves and Lissajous figures.

The student is thereafter introduced to simple diode and transistor tests, using the oscilloscope and finally to the waveforms around a television receiver, with some reference to colour receivers.

All told, it is a book that I can readily recommend to any student or hobbyist to whom the oscilloscope is, as yet, a green-eyed mystery box. Our copy came direct from the publishers but we understand that stocks will be available in Australia within a few weeks. The Australian price will be \$6.15. (W.N.W.)

## Amateur circuits

**AMATEUR RADIO CIRCUITS BOOK**, Second edition, 1968. Compiled by R. Jessop, C. Eng., MIERE, G6JP. Published by the Radio Society of Great Britain. Stiff paper covers, comb binding, 120 pages, 8½ x 5 inches.

Having been compiled and published with the backing of the RSGB — by amateurs, for amateurs — this new second edition contains a wealth of information

of potential value to Australian licensed amateurs. There is virtually no connective text. The whole book is given over, rather, to circuits — on an average of about two per page — with brief explanatory notes relating to circuit function, coil data, etc.

Most of the circuits and diagrams relate to individual stages or functional blocks, which can be strung together in the desired fashion to form complete pieces of equipment. In a few cases, complete circuits are given.

Logically enough, the book begins with four pages devoted to aerial matching units, SWR indication and TR switches. This is followed by three pages of pre-amplifiers, valve and transistor, HF and VHF.

Converters occupy the next fourteen pages and again there is a variety of design, likely to meet a wide range of requirements. In turn the book covers IF filters and Q-multipliers, S-meters, and detectors — AM, FM and SSB. Audio and audio AGC systems, noise limiters and noise blankers round off the receiving section.

Coming to transmitters, there are several complete circuits, leading into power amplifiers and linear amplifiers, transverters and AM, FM and SSB modulators. Speech amplifiers, mixers and keyers receive their share of attention, followed by a comprehensive selection of oscillator circuits. After a section on power supplies, the book is rounded off with a group of circuits for test equipment of the type most likely to be of use around the "ham shack".

All told, the book should be a quite invaluable source of practical circuits and ideas for Australian amateurs and a relatively inexpensive one at that. Our copy came direct from the Radio Society of Great Britain, with a covering letter which indicated that the price in Britain is 10/6 plus postage. Even allowing the cost of shipment and resale in this country, it is still very good value. The publisher's address: Radio Society of Great Britain, 28 Little Russell St, London, WC1. (W.N.W.)

## Oscilloscope handbook

### HANDBOOK OF OSCILLOSCOPES

Theory and Application. By John D. Lenk. Hard covers, 212 pages 8½ x 5½ inches, illustrated with diagrams and pictures. Published 1968 by Prentice-Hall Inc., Englewood Cliffs, N.J. Australian price \$9.30.

No wonder the name of John D. Lenk is a familiar one in the realm of electronics literature. The dust-cover notes indicate that this is his seventeenth book, not to mention the many articles which have appeared over his name in well-known American electronics journals.

This book is written primarily for students, technicians and others who may have occasion to use oscilloscopes in laboratory work at a modest level. It aims to provide a background of general knowledge which will allow the person concerned to make more immediate use of the detailed manuals which most manufacturers provide with their individual instruments.

The early chapters, 1-5, deal with oscilloscopes generally: Oscilloscope Basics; Basic Operating Controls; Oscilloscope Specifications and Performance; Oscilloscope Probes and Accessories; Basic Operating Procedures and Recording Methods. This is all fairly straightforward material, clearly set out and clearly illustrated, textbook style.

Scanning these chapters revealed a few minor points for possible argument or discussion. Page 27: the illustration of non-linearity is rather non-typical. Page 34: the waveforms are of debatable accuracy in relation to the high frequency compensation of probes. Page 37: electronic switches do not operate of necessity above either signal frequency; they can be

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a submultiple of the sweep frequency. Page 40: the procedure for placing an oscilloscope into operation is anything but typical of ordinary workshop practice. These are small points perhaps, but they did manage to catch this reviewer's attention.

From chapter 6 onwards, the book is devoted to what the author defines as "cookbook" instructions in relation to the measurement of voltage, current, time, frequency and phase. There is a chapter on using oscilloscopes with sweep generators, and another on testing individual components, with particular reference to semiconductors.

The remaining chapters deal with tests performed on audio amplifiers, communications equipment, industrial equipment and, finally, television receivers.

All told, it is a useful book and well worth inspection by anyone seeking the information which it contains. Our copy came from Prentice-Hall of Australia Pty. Ltd., 242 Pacific Highway, Crows Nest, N.S.W. 2065. (W.N.W.).

## LITERATURE—in brief

**SCIENTIFIC EQUIPMENT**, No. 3, August, 1968, the new products guide published by Watson Victor Ltd., includes brief descriptions of the following items:

Goerz recorders; Halogen leak detector and magnetic field meter; Multitone personal paging system; Medical Electronics Ltd. temperature environmental test equipment; Qualtrex drying cabinets; Duro-Lab Luke ultrasonic cleaner; Hilger & Watts monochromators; API Instrument Co. pyrometer and temperature controller and digital panel micro-ammeter; Milton Roy Co. hydrogen generator and colorimetric analyser; Perma-Sharp knife sharpener.

Inquiries to Watson Victor Ltd., 95-99 Epping Road, North Ryde, N.S.W. 2113, or branches in other States and New Zealand.

**PRINTED MOTORS LTD.**, Fleet, Hants, England, has published a series of technical articles on the subject of printed motors. Copies of these may be obtained on application (on company letterhead) to the Australian agents, Tecnico Electronics Pty. Ltd., Box 12, P.O., Marrickville, N.S.W. 2204. The articles available are entitled:

The characteristics of the printed motor. General notes on the application of printed motors to tape handling and computer input-output equipment.

Printed motor phase lock servo system. Servo amplifiers for printed motors.

An appreciation of the characteristics of electric clutches and brakes and direct drive low inertia motors.

The use of the low inertia motor in a numerical controlled machine tool.

**A BIBLIOGRAPHY ON METHODS FOR THE MEASUREMENT OF INHOMOGENEITIES IN SEMICONDUCTORS (1953-1967)**, by Harry A. Schafft and Susan Gayle Needham, National Bureau of Standards (U.S.A.) technical note 445, issued May, 1968, 45 pages, price 35 cents U.S. About 130 papers dealing with the measurement techniques used in detecting the type and location of various inhomogeneities, primarily in germanium and silicon, are listed. The publication contains three indices — a reference tabulation according to key words, a reference tabulation according to methods or effects used to detect an inhomogeneity, and an author index.

Copies of the publication may be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, U.S.A. Remittances should be in U.S. exchange, and include an additional 25 per cent to cover mailing costs.

**THE ITU AND SPACE RADIO-COMMUNICATIONS** is an illustrated 40-page brochure published by the International Telecommunication Union (ITU) which reviews its work in the field of space radiocommunications. The contents are: Preface by the Secretary-General of the ITU; general space radiocommunications; Radiocommunications in the service of satellites; Satellites in the service of telecommunications; The ITU and technical co-operation in space matters; Terminology; ITU documents; Resolution on the role of the ITU in space telecommunications; Information about the ITU. The brochure, in 30cm x 21cm (12in x 8½in) format, may be obtained free of charge on request to the Sales Section, International Telecommunication Union, Place des Nations, 1211 Geneva 20, Switzerland.

**HEWLETT-PACKARD JOURNAL**, Vol. 19, No. 8 (April, 1968) includes the following articles: What is Signal Averaging?—describing how repetitive waveforms buried in noise can often be recovered by a signal averager; Calibrated Real-Time Signal Averaging — describing the HP model 5480A Signal Analyser; Off-Line Analysis of Averaged Data—a new input/output coupler for use with the 5480A. Inquiries to Hewlett-Packard Aust. Pty. Ltd., 22-26 Weir Street, Glen Iris, 3146.

**ILFORD (AUST.) PTY. LTD.** has published a technical information sheet P 40-1 describing the technique of producing reversals of ordinary black-and-white film. The process is described in sufficient detail for those who do their own developing to follow. Available free on request to the company at 214-216 Willoughby Road, Crow's Nest, 2065.

**TELECOMMUNICATIONS JOURNAL**, Vol. 35, No. 8, August, 1968, is entirely devoted to space communication. In 88 illustrated pages, it reviews the work done and the results obtained in space radiocommunication in 1967, and analyses emerging trends in the creation of national and regional communication satellite systems. The issue includes an insert map of Earth stations to be used by the satellite communication services. A sliding transparency is provided with the map for determining the area covered by a geostationary satellite on the basis of its position above the Equator.

The journal is published by the International Telecommunication Union in separate editions in English, French and Spanish for an annual subscription of 25 Swiss francs per language. Price of the August special issue, 5 Swiss francs. Copies may be obtained from the Sales Service, International Telecommunications Union, Place des Nations, 1211 Geneva 20, Switzerland.

**MARCONI INSTRUMENTATION**, Vol. 11, No. 4, May, 1968, published by Marconi Instruments Ltd., St. Albans, Hertfordshire, England, contains the following articles: Techniques for the measurement of quartz crystal parameters; A precision FM VHF/UHF signal generator; Measuring the resistance of PIN diodes on a Q meter; High power inductance measurement.

**CORNING GLASS WORKS** has available data sheets describing the Electrosil triple rated glass-tin-oxide resistors, Type TR. These have been designed for applications where a very small, highly reliable, low cost resistor is required. Each resistor can be used at three power ratings corresponding with semi-precision, high stability, and general purpose applications. Inquiries to the company at 1202 Plaza Building, 87 Pitt Street, Sydney, 2000.

**EMERSON AND CUMING INC.**, Canton, Massachusetts, U.S.A., has published two four-page folders describing some of the latest advances in the design and construction of Ecosorb Anechoic Chambers and RF Shielded Chambers. Several of the most recently built chambers

are pictured together with a description of the novel features, as well as performance characteristics. Inquiries to the Australian agents, Wm. J. McLellan and Co. Pty. Ltd., The Crescent, Kingsgrove, 2208.

**A. F. BULGIN AND CO. LTD.**, Barking, Essex, England, has published a new edition of the Bulgin catalogue of electronic components. This 200-page publication is available through R. H. Cunningham Pty. Ltd., 608 Collins Street, Melbourne, to the trade by application on official letterhead.

**NEW DEVELOPMENTS**, issue B037, August, 1968, the new products guide published by Jacoby, Mitchell and Co. Pty. Ltd., includes the following items: Wandel u. Goltermann signal generator; Technical Products Co. AC to DC converter;

TRW laser and UHF transistors; CEC shock simulation equipment and tape recorder;

Sinus vibrometer; Wiltron transmission test set; Gosser volt/ammeter; Norma medical body thermometer; PRD attenuators.

Inquiries to Jacoby, Mitchell and Co. Pty. Ltd., 469-475 Kent Street, Sydney, 2000.

**MOTOROLA SEMICONDUCTOR PRODUCTS INC.**, Phoenix, Arizona, U.S.A., has published a loose-leaf technical data brochure to provide designers with continually updated information about the company's line of IC resistor-transistor logic circuits. The brochure, of over 100 pages, includes 50 different Motorola MRTL and mW MRTL circuit functions grouped into four different sections: medium-power MRTL circuits; low-power mW MRTL circuits; Unibloc plastic-packaged devices (both medium- and low-power units); medium- and low-power devices for commercial use.

**MOTOROLA** is represented in Australia by Cannon Electric (Aust.) Pty. Ltd., 58 Cluden Street, East Brighton, Vic. 3187.

**HEWLETT-PACKARD** has published a frequency domain measurement booklet for design engineers. The booklet sets forth the benefits which the engineer can realise if he has access to a stable, fully calibrated modern spectrum analyser. Inquiries (on company letterhead) for this 16-page booklet should be addressed to Hewlett-Packard Aust. Pty. Ltd., 22-26 Weir Street, Glen Iris, Vic. 3146.

**SERVICE SCOPE**, No. 49, April, 1968, published by Tektronix Inc. of the U.S.A. to provide information for users of Tektronix instruments, includes the following articles: Developing a Writing Speed Specification — describing the factors influencing writing speed and giving results of experiments; Direct-View Bistable-Storage CRT Resolution — giving a definition and explanation of resolution for information display CRTs; Circuit Concepts from Tektronix — introducing literature to assist in training field engineers, and reproducing material from "Cathode-Ray Tubes," one of the titles available; Service Notes; Basic Functions of Attenuators, Terminations and Adapters.

Inquiries should be addressed to the Australian company, Tektronix Australia Pty. Ltd., 4-14 Foster Street, Sydney, N.S.W.

**MICRO STATE ELECTRONICS**, a division of Raytheon Company, Murray Hill, New Jersey, U.S.A., has published the following leaflets: Microwave Semiconductors and Computer Switching Diodes; The Micro State Line of Silicon PIN Diodes; GaAs and Ge Tunnel Diodes for High Speed Switching Applications. Copies are available on request from the Australian agents, Auriema (Asia) Pty. Ltd., 443 Kent Street, Sydney, N.S.W. 2000.

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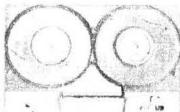
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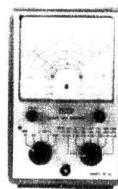
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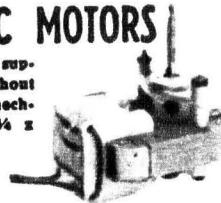
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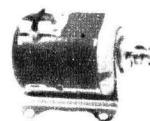
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**FREE** With each lot of resistors, condensers or pots, we will supply free one new valve type 6U7G, 6X5GT, 1T4, 6K7G, or 12AT7. Resistors, condensers and pots are in packs of 100 or 12 and we regret we cannot supply to individual lists of values or types.

## New Hi-Fi Sound Recording Tapes. All Mylar Base.

3" x 150ft	60c
3" x 225ft	75c
2 $\frac{1}{2}$ " x 300ft	85c
3" x 300ft	85c
3 $\frac{1}{2}$ " x 600ft	1.75
5" x 600ft	1.50
5" x 900ft	2.00
7" x 1200ft	3.00
7" x 1800ft	3.75

Post and Packing, 25c extra.

LEADER SIGNAL GENERATOR LSG11  
240V A.C. operated, 6 band  
120KC to 390 Megs. Provision  
for crystal. Post  
N.S.W., 75c; Interstate, \$1.25.  
\$34.00

## USED HIGH-SPEED 240V. AC/DC MOTORS

These 240v. A.C. or D.C. motors are 1/8 H.P. with a speed of 7,000 R.P.M. and are ideal for small drills, grinders, etc. Dimensions, 3 $\frac{1}{2}$ in x 3 $\frac{1}{2}$ in, with 5/16in spindle. Post, N.S.W., 50c; Interstate, 85c.

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**ROTARY SWITCHES and  
ROCKER SWITCHES**

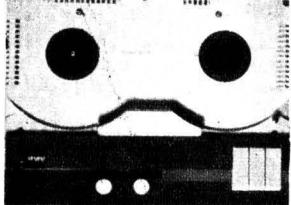
1 Bank 11 x 1 or 5 x 2, 69c  
1 Bank 3 x 3 . . . . . 60c  
2 Bank 5 x 2 . . . . . \$1.20  
Rocker Type D.P., D.T.,  
50c.  
Post and Packaging  
15c extra.

## NEW BOOKSHELF SPEAKERS

Uses 6" Magnavox Dual Cone Speaker plus 3TC. Tweeter with cross-over condenser. Dimensions 14" x 8" x 9" deep.  
**\$17.50**  
Post and Packing Extra.  
N.S.W. \$1.50.  
Interstate \$2.00.



## THE NEW COLLARO



## 3-SPEED 4 TRACK TAPE DECKS

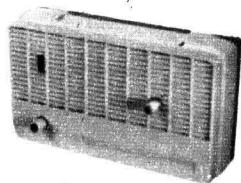
**\$55.00**

The ideal deck for the home constructor, as amplifier and all controls can be mounted on deck.

• 3-speed 1 $\frac{1}{4}$ , 3 $\frac{1}{4}$ , 7 $\frac{1}{2}$ . • Pause control. • Takes 7in spools.  
• Simplified controls, 4 Tracks, \$55. OSC Coils, \$1.50.

## NEW 4" EXTENSION SPEAKERS

These 4" speakers are mounted in plastic cabinets suitable for use as intercom, units or extension speakers. Fitted with switch and volume control. SPECIAL PURCHASE ENABLES US TO SELL THESE UNITS AT \$5.00. Post and Packing, N.S.W., 60c. Interstate, 98c.



## A PREAMP FOR MAGNETIC PICK-UP OR TAPE HEADS

### SUITABLE FOR USE WITH THE COLLARO OR B.S.R. TAPE DECKS

Using 3 silicon transistors as featured in October Electronics Australia complete with kit of parts including transistors mono \$7.50, stereo \$13.00, 240 power supply for above \$7.00. Please specify if required for pick-up or tape heads.



## NEW 17 & 25 WATT P.A. AMPLIFIERS

The 25 Watt Amplifier uses 5 valves plus 2 rectifiers including two EF86 low noise valves as microphone preamplifier and two EL34 valves Ferguson push-pull output.

All amplifiers are fitted with Ferguson output transformers with voice coil tappings of 2 to 15 ohms. The 25 watt amplifier can be supplied with line output transformers tapped from 100 to 600 ohms if required at \$2.00 extra.

Inputs provided for microphones, pick-up, and radio with mixing facilities and tone control.

The 15 watt is as above but using two 6BQ5 valves in push-pull output.

12in speaker for above (10 watt) . . . . . \$7.75

Crystal Microphones for amplifier . . . . . \$5.75

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# NEW TRANSISTOR 8 KIT SET

SPECIAL PURCHASE ENABLES US TO OFFER THIS KIT SET AT \$24.00



DIMENSIONS

9" x 5" x 3" DEEP

(WIRED AND TESTED \$6.00 EXTRA)

- Complete kit of parts with circuit and full instructions
- Eight transistors.
- Magnavox 5X3 speaker gives excellent fidelity.
- High sensitivity, suitable for city or country use.
- Heavy duty battery for economical operation.
- Modern design, plastic cabinet with gold trim.
- Dial calibrated for all states.
- Available in colours of off-white, red, black or light green.

Post & Packing extra. N.S.W. \$1.25, interstate \$1.75.

## NEW TRANSISTOR CAR RADIO

New transistor six car radios with R.F. stage, of Aust. manufacture using A.W.A. components and transistors.

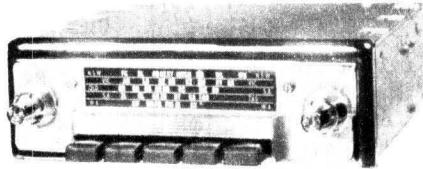
Available in manual or push-button models with dial calibrated for all Australian States.

Supplied with speaker (5", 6", 5 x 7" OR 6" x 9") and lock-down aerial.

MANUAL MODEL ..... \$43.00

PUSH-BUTTON MODEL ..... \$48.00

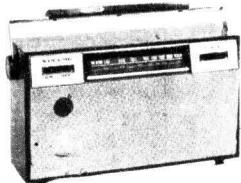
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Suitable for 6 or 12 volts for positive or negative earth. Please state type required.

## NEW TRANSISTOR SIX PORTABLE KIT AT LESS THAN HALF PRICE

(DESIGNED TO SELL AT OVER \$60.00)



\$23.75

Excellent fidelity is obtained in this new kit set by the use of large speaker and polished timber case with attractive gold metal front panel. By using heavy duty batteries it is economical to operate and is ideal for portable use or that second set. Complete kit of parts is supplied with full instructions.

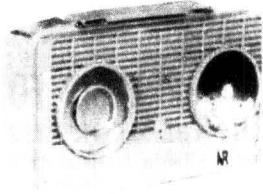
Post and packing N.S.W., \$1.25—Interstate, \$1.75.

## SPECIAL—OFFER

Complete KIT for TRANSISTOR 6 PORTABLE \$17.50

The complete kit of parts for the transistor six includes six transistors, printed circuit board, coil kit, 4in speaker, Ferguson driver and output transformers, heavy duty battery and all necessary parts to complete the set with full instructions. Set is housed in attractive plastic case as illustrated.

Dials available for all States. Post and Pack: Extra. N.S.W., \$1.00. Inter., \$1.30.



## NEW ENGLISH and AMERICAN TRANSISTORS AT 1/4 LIST PRICE

Ideal for the experimenter or service man.  
Each package of 12 contains 3 of each of the following types.

PACKET OF 12 FOR \$3.00

Mazda XA101.

Equivalent:

OC45 R.F. Transistor.

Texas 2N1108.

"

OC44 OSC. Transistor.

Texas 2N1111.

"

OC75 General purpose

Texas 2N1110.

"

OC45 R.F. Transistor.

THESE TRANSISTORS  
CAN BE SUBSTITUTED  
FOR MANY OTHER  
TYPES.

Post and Packaging 10c  
extra.

# NATIONAL RADIO SUPPLIES

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# AMATEUR BAND NEWS AND NOTES

## Unattended VHF Repeaters Approved

The Postmaster-General's Department has approved the use of unattended VHF/UHF repeater stations by the Australian amateur service.

By Pierce Healy, VK2APQ\*

The installation and use of unattended translator/repeaters on the VHF and UHF amateur bands was approved by the Postmaster-General's Department last August for use by the Australian amateur service. This approval followed representations made by the Federal Executive of the Wireless Institute of Australia.

During recent years, the use of repeater stations by amateur operators has been the subject of discussion among members of the various state Wireless Institute Civil Emergency groups, who considered that such a system of VHF/UHF communication would be advantageous; particularly for mobile operation should WICEN be called upon to participate in handling emergency traffic in a communication network.

Within the terms of the licensing regulations, manned translator/repeater units were used on occasions during the disastrous Victorian bushfires. It has also been considered that translator/repeater installations would allow greater use to be made of the VHF/UHF amateur bands for local communication links between amateur stations. In particular, between city and outlying areas where, due to the nature of the terrain, point to point communication on these frequencies is not possible. Also, their use would enable contacts to be made between city and country areas and isolated amateur stations.

Efforts are being made among groups of interested amateur operators to rationalise the frequencies to be used, so that, amateur operators travelling interstate or in outback country areas will be able to use the facilities that may be available through translator/repeater installations within each area. To this end, various interstate groups are exchanging ideas on the type of equipment that could be used, frequencies to be used at various centres and locations that would serve the largest area.

The proposals are not without problems, such as the initial cost of the installations, operating and maintenance costs and the responsibility for installations in relation to the Postmaster-General's Department. The solution to these and other problems will no doubt be the result of inherent amateur operator ingenuity.

At the present time there are several hundred VHF mobile stations operating throughout Australia using modified commercial units that have been available on the disposal market. These units have been converted for operation on the 144MHz and 52MHz amateur bands. By far the greater number of these stations

use frequency modulation although provision has been made for amplitude modulated channels.

The text of the approval released through W.I.A. sources was:

"I. The Postmaster-General's Department will approve the use of repeater-translators in the VHF amateur bands either on an experimental basis or on a permanent unattended installation basis.

"II. Such repeater or translator may either re-transmit within the same band or to another band. It is anticipated that such equipment will not be operated on frequencies below 144MHz, though consideration may be given to their use in the 52MHz amateur band.

"III. Any application (to be made to the Superintendent of Radio in the State concerned) will be considered on its merits and the Department will have regard to the following points:

(1) The number of translators permitted will be restricted to avoid undue interference in amateur bands.

(2) The Department will require to be satisfied that the design and construction of the particular equipment, in respect of which permission to operate is sought, is of a satisfactory technical standard, though reasonable allowance will be made for experimental devices.

(3) The following technical points should be noted:

(a) The equipment should include arrangements for 'fail safe' operation, i.e., failure of any component will not cause the transmitter to lock on.

(b) The equipment shall be adequately and regularly maintained. A record shall be kept of all essential meter readings obtained during each maintenance visit, the repairs, adjustments and other maintenance undertaken, the purpose of the maintenance operation, and the times of switching on and switching off the translator.

(c) Any form of modulation appropriate to the band in use may be employed. Where system design requirements apply, means should be provided to avoid modulation in excess of allowable limits as a function of received signal strength.

(d) No transmissions shall take place in the absence of a received carrier, or, if so desired, voice or other modulation intended to convey intelligence.

"IV. The Department will have to be satisfied that a permanent installation is desired by a reasonable number of amateur operators in the area concerned.

"V. Net frequencies or other normally frequented band areas shall be avoided for both input and output channels of repeaters/translators except where there is general agreement among amateur operators regarding such usage.

"VI. The Department will have to be satisfied that the equipment is safe from unauthorised operation and can be quickly turned off in the case of malfunction.

"VII. The site chosen must be acceptable to the Department. Transmit and receive frequencies shall be approved by the Department. As the amateur service is the secondary service in bands above 144MHz, some restriction may be necessary in regard to the use of specific frequencies in these bands.

"VIII. Permission to use such equipment will be granted on a basis somewhat similar to the licensing of a radio club — namely one individual amateur will be nominated as being responsible for the operation of the equipment.

"IX. To avoid the need for repeater/translators to be fitted with equipment for identification purposes, stations communicating through them should include in their calling a particular repeater/translator identification.

"The Department suggests that, wherever appropriate, the local W.I.A. organisation should co-ordinate applications. It is suggested that persons seeking the use of these facilities should not hesitate to make personal contact with the appropriate officer in their state, to ensure the fullest possible mutual co-operation."

It must be appreciated that the implementation of the current arrangements may bring to light difficulties that have been overlooked. However, no insurmountable problems are expected. Members of the Tasmanian Division of the W.I.A. and the Australis Project group were responsible for preparing details used as the basis of the W.I.A. submission to the Postmaster-General's Department.

### INTRUDER WATCH

The Federal Intruder Watch co-ordinator, David Wardlaw, VK3ADW, reports that progress is being made with the Australia-wide organisation to report on the intrusion of commercial stations into exclusive amateur frequency assignments. The object of the Intruder Watch organisation is to identify and log the transmissions of commercial stations who depart from the International Telecommunication Union agreements on frequency allocations.

All reports received will be correlated and passed to the appropriate authorities requesting that steps be taken to eliminate the illegal use of exclusive amateur frequencies. The Intruder Watch organisation operates very effectively in Britain and western European countries, as a function of the International Amateur Radio Union Region 1 organisation.

Amateur operators and short-wave listeners are invited to co-operate with the various state co-ordinators by sending in reports on such intrusions that they hear. It has also been suggested that radio clubs encourage their younger members to participate in this activity as a means of increasing and improving their ability as a shortwave listener, which is very often the starting point to becoming a fully fledged amateur operator.

Full details on the form and information required in reports on the activities of intruding stations may be obtained by writing to either the Federal Co-ordinator D. Wardlaw, VK3ADW, 21 Tormey Street, North Balwyn, Victoria, 3104, or the following state co-ordinators:—

\* News and notes of Divisional and Club activities submitted for inclusion in these columns should be forwarded direct to Pierce Healy, 69 Taylor St., Bankstown, N.S.W., 2200.

# INTRODUCING the HEATH IM-25



**a high value, high performance, solid state V.O.M.  
which can be line or battery operated**

**LOOK AT THESE "VALUE PLUS" FEATURES:**

- 13 Silicon transistors plus 2 field-effect transistors.
- 11 megohm input impedance on DC.
- 10 megohm input impedance on AC.
- 9 DC voltage ranges from 150 millivolts full scale to 1,500 volts full scale . . . accuracy  $\pm 3\%$  full scale.
- 9 AC voltage ranges from 150 millivolts full scale to 1,500 volts full scale . . . accuracy  $\pm 5\%$  full scale.
- 7 resistance ranges, 10 ohms centre scale  $x1, x10, x100, x1k, x10k, x100k, x1$  meg . . . measures from one ohm to 1,000 megohms.
- 11 current ranges from  $15\mu A$  full scale to  $1.5A$  full scale.
- 1% precision resistors.

- Superior accuracy on current measurements . . .  $\pm 4\%$  on DC . . .  $\pm 5\%$  on AC.
- AC response to 100 kHz.
- 6",  $200\mu A$  meter with centre zero scales for positive and negative voltage measurements without switching.
- Separate switch for each function eliminates constant changing.
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NEWCASTLE WEST: 61-4077; PERTH: 8-4131;  
SYDNEY: 29-1111; WOLLONGONG: 2-5444.

WF140/68

W. H. R. Treloar, VK2BPZ, 238 Fullerton Street, Woolahra, N.S.W. 2025.

M. P. Davis, VK3ANG, 144 Tramway Parade, Beaumaris, Victoria. 3193.

D. H. Kelly, VK7DK, 56 Upper Brougham Street, Launceston, Tasmania. 7250.

G. Allen, 283 Amelia Street, Balga, Western Australia. 6061.

#### I.T.U. FUND

The Wireless Institute of Australia I.T.U. Fund being subscribed to by amateur operators and other persons interested in the welfare of amateur radio for the purpose of financing a representative to International Telecommunication Union Conferences should the need arise, now stands at more than \$6,000. Although this figure is below the target set several years ago by a Federal Convention of the W.I.A., contributions are still being sent to divisional secretaries.

The necessity to have amateur representation at such international conferences was one of the main reasons for the formation of the I.A.R.U. Region III organisation last Easter in Sydney. Contributions to the fund should be sent to W.I.A. Divisional Secretaries at any of the following addresses.

N.S.W.—14 Atchison Street, Crows Nest. 2065.

Victoria—P.O. Box 36, East Melbourne. 3002.

Queensland—Box 638J, G.P.O. Brisbane. 4001.

South Australia—Box 1234K, G.P.O., Adelaide. 5001.

Western Australia — Box N1002, G.P.O., Perth. 6001.

Tasmania—Box 851J, G.P.O., Hobart. 7001.

#### REMEMBRANCE DAY CONTEST

From reports received and from actual participation in the contest it would appear that the 1968 Remembrance Day Contest, held over the weekend August 17-18, was most successful and the final results should equal that of previous years. Conditions on all bands appeared to be good but no reports have been received of interstate DX contacts on the VHF bands.

The contest was officially opened by broadcasting from all W.I.A. divisional stations, of a recorded address by the Hon. Paul Hasluck, Minister for External Affairs. In his address Mr Hasluck said:

"It is a privilege to address the radio amateur operators of Australia on Remembrance Day.

"Last year on this occasion when you were addressed by my colleague, the Minister for Defence, Mr Fairhall, he had a distinct advantage over me, for he is a radio amateur operator himself and knows many of you well, is an active member of your fraternity and also knows your ways and your language.

"I myself know very little about radio, and I still have a tendency to speak of it as wireless. But I notice your own organisation is the Wireless Institute of Australia.

"Now, although my own acquaintance with amateur radio has been limited I will try to pick out and name some of the qualities that the radio amateur seems to have.

"Firstly, he is obviously dedicated, his knowledge of radio is the mastery of a complicated piece of equipment he has assembled himself. The long hours he devoted to this activity tells of his dedication.

"Secondly, amateur radio operators seem to be internationally minded. His hobby is international by its very nature. Wireless crosses all political boundaries.

"Thirdly, radio amateurs seem to me to be a friendly outgoing lot, keen to extend their friendship and to make friends. No doubt you have other qualities in common, but I have remarked on these three — dedication, and international outlook and a desire to communicate and make friends, because they are

three qualities that are so much needed in international relations.

"Perhaps a fourth characteristic of the amateur radio operator is that he is a great talker and he does not need to travel further than his set to communicate with people in other lands, simply by pressing a key. Or, by speaking into a microphone, the amateur radio operator can talk to someone thousands of miles away.

"Now this is surely a remarkable power, and places you in a unique position to advance international understanding. I feel sure that you always talk sense and always talk in friendliness. While the substance of your conversation may often be technical, this almost continuous dialogue between hundreds of thousands of amateur radio operators all over the world also gives a wonderful chance for friendly communication — the exchange of words between human beings interested in human values.

"Now, while wireless links between individuals are important elements in developing a better understanding between peoples, there is also a need for more formal organised exchanges and for more concerted action. I was pleased to learn therefore, that the Wireless Institute of Australia held a conference earlier this year to discuss methods of assisting amateurs in countries of Asia and Oceania. The conference was attended by delegates from Japan, the Philippines, New Zealand and the United States. A result of that meeting is the formation of an organisation with headquarters in Melbourne, and I am sure that this organisation will enable you to direct your international activities in a more systematic way than before.

"The new and developing countries of the world have a great interest in developing amateur radio, and in learning what goes on in the world, and if the radio amateurs of Australia, New Zealand and Japan, to name three of the

most developed countries of that region, with an amateur population of more than 60,000 — if they can pass on some of their knowledge, they will be a great help to the region as a whole.

"The development of good communications is a part of economic development. The technical knowledge required by the amateur operators is the same knowledge required for many positions in industry and in the Public Service, and so I commend the project to you — a valuable exercise in international co-operation.

"Australians, I believe, have played something of a pioneer part in the development of wireless. Along with aviation, wireless has played an important role in reducing distances, a major obstacle to our development.

"Wireless has helped reduce the great Australian loneliness and has done much in Australia to make Australians aware of their national unity and, just as amateur radio played an important part in the development of Australia's nationhood, I am confident it can play an important part in bringing nations together.

"The amateur radio operators have nourished the radio industry, stimulated many technical advances and provided a wealth of technical talent necessary for its development.

"The facilities you have built, the talents you have acquired in your recreation, are national assets which I am pleased to see are being used as effectively and with as much dedication in times of peace as in war.

"Today — on Remembrance Day — remember those radio amateurs who lost their life in the war. You are continuing a great tradition.

"In opening this Remembrance Day contest I give my good wishes and greetings to you. Keep on talking. Good evening."

## Dear Music Lover, What is a pick-up for?

These days it is not unusual to read through an advertisement for a high quality pick-up head without finding in it the word "music." Some people must wonder whether these pick-ups are built solely for the playing of "frequency records." However, the major consideration in all aspects of the design and manufacture of M.B.H. pick-ups is the quality of the end result—music. Every M.B.H. head has the usual readings taken on various frequency records as a matter of routine; but before an M.B.H. head gets as far as that, it must pass a listening test with different types of music. The music test is decisive, if the head does not pass this, any measuring tests are only in the nature of a post-mortem.

High compliance, low stylus mass, good frequency response, etc., do not automatically bring musical excellence. A subtle balancing between all factors, found only by trial and error, puts in the finishing touches, whilst the measured performance may remain much the same. Pick-up design and manufacture is still more art than science.

After listening to the most expensive imported Stereo pick-ups, we have no hesitation in saying that the Stereo M.B.H. "L" series sounds better musically. A bold statement indeed, but one you can check without instruments.

And of course we forgot to mention! The M.B.H. (Harris) pick-up is Australian made and has been tested against the world's best.

Write today for a technical brochure and price list. Then we hope you will try one because the price is right too.

*Yours Sincerely,*

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15 "	60 "
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All ratings R.M.S. and provides for a tuner output voltage rise between Load and No Load less than 2 DB.

These amplifiers have been checked by the R.M.I.T. and passed for the State Education Department, also accepted by the P.M.G. Fully protected against shorted speaker lines.

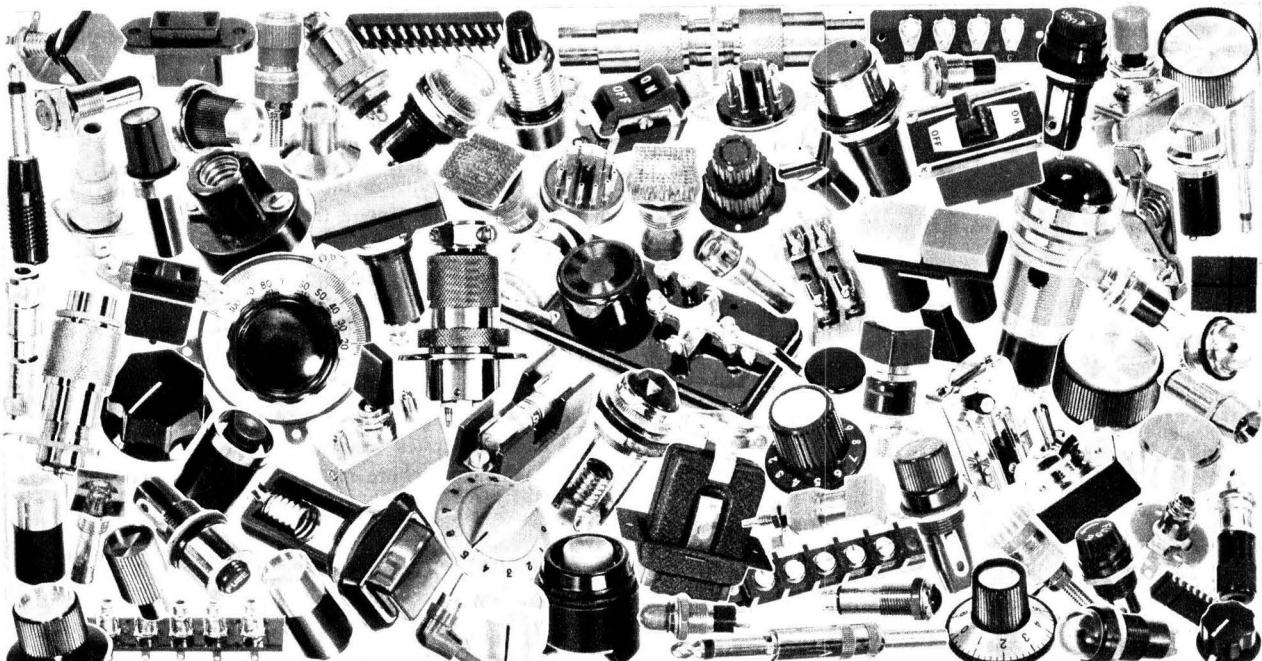
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## REGION I NEWS

In the April issue of the Region I Bulletin a number of interesting and thought-provoking items are recorded. The announcement that a Beginner's Licence is to be issued by the British Post Office has caused some concern among amateur operators.

In his editorial John Clarricoats, G6CL, comments:

"An announcement by the U.K. Postmaster-General on March 11, 1968, that a Beginner's Licence is to become available later in the year—to encourage interest in radio by people not yet possessing the qualifications needed for a Full Amateur Licence"—has come as a complete surprise, not only to the council of the Radio Society of Great Britain but also to many thousands of licensed amateurs who stood aghast at the possibility of the chaos that could arise if thousands of irresponsible people—not yet possessing the qualifications needed for a full amateur licence—are allowed to operate in the already over-crowded DX bands.

"Within hours of the announcement being made, licensed amateurs in many parts of the United Kingdom were approached by young people possessing all kinds of illicit transmitting equipment asking for advice on how to get it 'on the air' as soon as a Beginner's Licence is available.

"The vast majority of licensed radio amateurs are proud of the fact that they are technically competent to operate their equipment as well as being capable of sending and receiving messages in Morse code at a reasonable speed. Article 41 of the Geneva (1959) Radio Regulations attached to the International Telecommunication Convention states, in Clause 1563, that 'any person operating apparatus of an amateur station shall have proved that he is able to send correctly by hand and receive correctly by ear, texts in Morse code signals. Administrations may, however, waive the requirement in the case of stations making use exclusively of the frequencies above 144MHz.'

"As is well known, several administrations have taken advantage of this clause and have issued what our treasurer described last year as 'Morse-less' licences. Even on the very day the U.K. Postmaster-General made his announcement about a Beginner's Licence he stated that the holders of Class B (Morse-less) licences (G8 plus 3 call signs) would, in future, be authorised to operate in the 144MHz-146MHz band. Previously their activities had been confined to 420MHz and higher frequencies.

"Of this decision few will quibble because, in the U.K. at least, the holders of this type of licence have passed the Radio Amateurs' Examination but how, we question, will the U.K. Postmaster-General be able to satisfy the requirements of Clause 1564 of the regulations which states that 'Administrations shall take such measures as they judge necessary to verify the technical qualifications of any person operating the apparatus of an amateur station' and at the same time introduce a licence 'to encourage interest in radio by people not yet possessing the qualifications of a full amateur licence.'

"At a time when the working week seems to get shorter and shorter, and leisure time appears to hang heavily on the hands of many young people, there should be no excuse whatsoever for any Government administration to relax the international requirements which have, for nearly 50 years, made the amateur service unique. Any one with the desire to learn should find no difficulty in passing a technical examination and a proper test of Morse code proficiency.

"During recent weeks we have become increasingly concerned to read of the activities of an American commercial concern (Electronic Industries Association, of Washington, D.C.) who have

petitioned the United States Federal Communications Commission to extend, still further, the privileges—and they are privileges—granted to holders of the Novice Licence. The petition is not supported by the A.R.R.L. and will, we hope, be rejected by the F.C.C. as not being in the best interests of international amateur radio.

"In just about 12 months' time, the subscribing member societies of the I.A.R.U. Region I will be meeting in Brussels to discuss problems concerning amateur radio. To take a hard cold look at the licence position generally in Region I would seem to hold high priority among the subjects to be discussed at the conference."

### ITALY

Members elected as office bearers of the A.R.I. for 1968 were:

President Gianfranco Sinigaglia I1BBE  
Vice-presidents S. Cassina I1AHN, F. Amoretti I1KFB.

General Secretary and Editor of Radio Revista Sergio Pesce I1ZCT  
Assistant Secretary A. Realini I1RCR  
Treasurer and VHF Manager G. Mikelli I1XD

It is reported that the efforts of the new committee will be particularly directed towards improving relations with the licensing authorities with the view to obtaining better frequency allocations for Italian radio amateurs. Efforts will be made to persuade the authorities to enter into reciprocal amateur licensing agreements with other countries. The committee will also urge the authorities to issue mobile licences and to authorise amateurs to transmit television in the 420MHz band.

Shortly after the disastrous earthquake last January, which killed about 500 people in Sicily, a number of amateurs located in and around Palermo set up emergency communication facilities, and

during the following days hundreds of messages were transmitted to amateur stations on the mainland of Italy, particularly to Naples, Novara and Genoa, to relatives of families caught in the disaster area.

A full scale emergency communication expedition was about to leave the mainland for Sicily when normal communications were restored.

### MAURITIUS

The recently formed Mauritius Amateur Radio Society has applied for membership of the International Amateur Radio Union. A comment from members was "It is fitting that our society, as representing the radio amateurs in a country soon to become independent, should have the opportunity to join the ranks of the I.A.R.U. It is recognised that the work of the I.A.R.U. and I.A.R.U. member societies at the 1959 Geneva I.T.U. Conference prevented the loss of large portions of the frequency spectrum assigned to the amateur service."

A training program for those who aspire to become radio amateurs is now in full swing. This has been assisted to some degree by a consignment of technical books as a gift from the A.R.R.L. and the R.S.G.B.

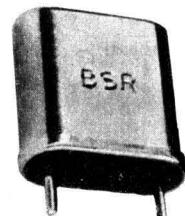
### MARITIME WORLD ADMINISTRATIVE RADIO CONFERENCE

The conference held in Geneva late in 1967, dealing with Maritime Mobile Services, found that, due to the previous revision (in 1959), those Radio Regulations related to the Maritime Service required substantial revision. This was due to the considerable expansion in radio telephone and radio telegraph traffic. Timetables were drawn up for the progressive introduction of the new provisions, which will affect the type of radio equipment installed in ships and coast stations in the Maritime Mobile Service.

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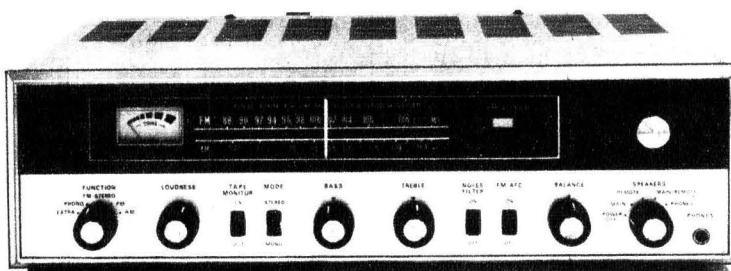
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# monarch:

## the miser

Penny-pinching cannot be condoned where hi-fi's concerned. Except . . . where the customer is perhaps just a beginner in the stereo world, or even a man-on-a-budget. He has to be miserly with his money, he has to limit himself to a medium price range, yet he'd like the finest equipment available in this price range. This is where Monarch Amplifiers excel. The three models below represent the best value for anyone's money: the highest possible standard of fidelity at a medium — **you could call it miserly — price!**



### MODEL SAT-460X Solid State AM/FM Mpx Stereo Tuner Amplifier

**Transistors:** 32 transistors, 19 diodes.  
**Output Power:** 26 watts per channel at 8 ohm (IHF).  
**Frequency Response:** 20-25,000 Hz  $\pm$  0.5 db.  
**Controls:** Tuning, Loudness, Balance, Bass, Treble.  
**Switches:** Input selector, speaker selector (with power switch), tape monitor, noise filter and FM-AFC.  
**Input:** Mag-Phone 3mV, Extra 200mV, Tape-in 200mV for maximum output.  
**Dimensions:** 16 $\frac{1}{4}$ " (W) x 4 $\frac{1}{4}$ " (H) x 11" (D).  
**Weight:** 18 lbs.



### MODEL SAT-260X

**Solid State AM/FM Mpx Stereo Tuner Amplifier**

**Transistors:** 22 transistors, 17 diodes.  
**Input:** Mag 2.5mV X-tal, 170mV Aux.  
**Output Power:** 13 watts per channel at 8 ohm (IHF).  
**Frequency Response:** 20-20,000 Hz  $\pm$  1 db.  
**Controls:** Tuning, volume, balance, bass and treble.  
**Switches:** Function, tape-monitor, mode, scratch filter, FM-AFC and loudness.  
**Dimensions:** 4" (H) x 14 $\frac{1}{2}$ " (W) x 10 $\frac{1}{2}$ " (D).



### MODEL SA-500

**Solid State Stereo Amplifier**

**Transistors Used:** Total: 14 transistors, 6 diodes.  
**Pre-amplifier:** "Mag" RIAA.  
**Equalizer:** "Mag" 3mV at 1KHz; tuner 150mV at 1KHz. "Ceramic" 30mV at 1KHz.  
**Sensitivity:** "Mag" 3mV at 1KHz; tuner 150mV at 1KHz.  
**Power Amplifier:** 15 watts/channel IHF.  
**Power Output:** 20-20,000 Hz  $\pm$  1 db.  
**Frequency Response:** 4, 8 and 15 ohms (Tapeout for tape recorder).  
**Output:** 10 $\frac{1}{2}$ " (D) x 4 $\frac{1}{4}$ " (H) x 13 $\frac{1}{2}$ " (W).  
**Dimensions:** 13 lbs.

Sole Australian Distributors  
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**N.S.W.** Stereo Music Systems, 193 Clarence Street, Sydney.  
 Magnetic Sound Industries, 387 George Street, Sydney.  
 Edels Pty. Ltd., 88 King Street, Sydney.  
 Kent Hi Fi, 432 Kent Street, Sydney.  
 A. Victor & Co., Cnr. Elizabeth St. and Wentworth Ave., Sydney.

**QLD.:** Modern Dictating, 555 Stanley Street, South Brisbane.  
**VIC.:** Danish Hi Fi, 941 Burke Road, Camberwell, Melbourne.  
**W.A.:** Musgroves Ltd., 223 Murray Street, Perth.  
 Alberts TV, 282 Hay Street, Perth.  
 Alfreds Emporium, Pier and Hay Streets, Perth.

Two of the main decisions of the conference were:

(a) The gradual introduction, up to January 1st, 1982, of single sideband radio telephony in the medium frequency bands allocated to the Maritime Mobile Service between 1605KHz and 4000KHz.

(b) The gradual introduction, up to January 1, 1978, of single sideband telephony in the high frequency bands allocated to the Maritime Mobile Service, between 4MHz and 23MHz. The introduction of single sideband mode will mean that the portion of the radio spectrum occupied by radio telephone services will be reduced by one half.

The conference recommended that a further Maritime World Administrative Radio Conference be convened in 1973 to establish a new frequency allocation plan for sharing-out the new single sideband channels to coast stations. The Conference also decided that there should be a re-arrangement of the frequencies assignable to ship radio telegraph stations using the high frequency maritime mobile service bands between 4MHz and 27.5MHz.

#### MONACO

The Association des Radios Amateurs de Monaco has applied for membership of the I.A.R.U. The society is concentrating on a training program to help keen young people to obtain their amateur operator's licence. Plans are also in hand to establish a beacon station using the call 3A2VHF. The issue of a diploma for working Monaco stations is also being considered.

#### USE OF INCORRECT PREFIXES

The secretary of the International Amateur Radio Club, Ted Robinson, F8RU has drawn the attention of the secretary of the International Amateur Radio Union, John Huntoon, to anomalies in the allocation of call-signs to amateur stations in certain countries.

It was pointed out that article 19 of the Geneva Radio Regulations states in paragraph 735, that 'Transmissions without identification or with misleading identification are prohibited.' Paragraph 743 states 'all amateur stations . . . shall have call-signs from the international series allocated to each country as given in the table of allocation of call-sign series in paragraph 747.'

Attention was drawn to the following anomalies:—AC3 (Sikkim); AC4 (Tibet) and AC (Bhutan) all of which fall into the block AAA-ALZ allocated to the United States of America; M1 (San Marino) which falls into the block MAA-MZZ allocated to the United Kingdom; PX (Andorra) which falls into the block PPA-PYZ, allocated to Brazil; UR2 (Estonia) which falls into the block allocated to the Ukrainian Soviet Socialist Republic and 7G1 (Republic of Guinea), which falls into the block 7AA-7IZ allocated to Indonesia.

Sikkim, Bhutan and Andorra do not possess an international allocation, neither are the countries concerned members of I.T.U. San Marino, although not a member of I.T.U., has been allocated the block 9AA-9AZ, Guinea has the block 3XA-3XZ and the U.S.S.R. has the blocks EKA-EKZ, EMA-EOZ, EXA-EZZ, RAA-RZZ, UAA-UQZ, UUA-UZZ, 4JA-4LZ. Both Guinea and the U.S.S.R. are members of I.T.U.

It was suggested that the Secretary of the International Amateur Radio Union draw the attention of the countries concerned to the anomalies. In his reply, John Huntoon referred to the practical difficulty of dealing with amateur communications which may not always follow the rules. He explained that it is the view of I.A.R.U. Headquarters that even if an amateur call sign prefix does not fit the international list, provided it has been issued by a national administration, its existence must be recognised.

It was also explained that as the I.A.R.U. does not have member societies

in most of the countries named, direct contact with the appropriate amateur body is difficult. Also, it would not be appropriate for the I.A.R.U. to deal directly with the telecommunications administrations concerned. However, in future, it will be indicated in A.R.R.L. Countries' List those prefixes which are being used but do not fit the international table.

#### NEW MEXICAN PREFIXES

To mark the occasion of the Olympic Games in Mexico City, radio amateurs in Mexico will, for 1968 only, use prefixes in the series 4A1, 4A2 and 4A3 instead of the customary XE prefix. Already 4A1CD, 4A1LLS, 4A2L and 4A2RE have been reported in overseas DX notes operating on a frequency close to 14.150MHz using single sideband around 0600GMT.

#### WORLD UHF RECORD

On January 21st, 1968, HB9RG and DJ4AU established a new world record for a two-way contact using CW and single sideband over a distance of 336KM on a frequency of 2300MHz. This contact eclipsed the previous record set by W1EFH/1 and W2BVU/1 in July, 1963, over a distance of 275KM.

The first Switzerland-Germany contact on that band took place on December 29th, 1967, between HB9RG and DJ3EN.

#### INDIA

From the secretary of the Goa Radio Amateur Society, G.V. Sulu, VU2GV, the following Press release was received.

"The Goa Radio Amateur Society is registered under the Societies Registration Act of 1860 in Goa, Reg. No. 216 dated 18th July, 1968, with the objective 'to promote and popularise experimenting in radio communication, electronics and allied sciences, as a pastime pursuit for the general public.'

"Goa Radio Amateur Society is the third registered amateur radio organisation in India; the other two being: Radio and Electronics Society of India, Bombay and the Amateur Radio Society of India, New Delhi."

To illustrate the significance of this news, here is an excerpt from the society's newsletter GRAS:

"VU2DIA, who moved from Port Blair to Panjim, has increased the number of amateurs in that area to three. For a population of over 520 million we have only 450 amateurs in India — less than ONE IN A MILLION."

"As such, three amateurs in Goa and 28 members in GRAS, within such a short time, is good progress; especially when even most of our educators do not realise the need for hobbies, much less scientific hobbies. However, Goa is a potential amateur haven, and we have only touched the fringe . . ."

India is in the area covered by the I.A.R.U. Region III organisation and is one of the countries it is hoped will be assisted in its future development, as far as amateur radio is concerned, by the Region III organisation which was formed in Sydney last Easter.

#### NEW COUNTRY FOR 52MHz DXCC

From George Francis, VK3ZCG, comes the news that Gavin, VK4EV, is now operating from Willis Island. He is active on 3.5MHz and 14MHz single sideband and will soon be operating on 52.155MHz single sideband most mornings between 0600-0800EST, also during the day at weekends and most evenings.

Willis Island is listed as a separate country for the DXCC award. Mail is received every four months, and the address is — G. W. Brain, Willis Island, C/o O.I.C. Meteorological Office, Garbutt Airport, Townsville, 4810, Queensland.

## WIRELESS INSTITUTE ACTIVITIES

Federal Executive of the Wireless Institute of Australia has finalised a series of discussions with Mr C. Carroll, Controller Radio Branch, Postmaster-General's Department. Among the points finalised was the use of repeater/translators referred to elsewhere in these notes and the use of English in relation to call signs.

The Post Office has requested that stations in the amateur service announce call signs in the English language. No objection is made to the announcement of call signs in a foreign language so long as the announcement is also made in the English language. The appropriate amendment will be made to the Handbook, and the Institute was asked to give early publicity to the request.

#### NEW SOUTH WALES

Mr George Wilson, VK2AGO, has retired from the position of Secretary/Treasurer of the Division, a position he held for the past 18 months. George's drive was responsible for several improvements in the financial administration by council. The thanks of council and members has been expressed for the work he had put into such an onerous task.

The position has been filled by Charles Quin, VK2AWQ. Charles was very active in Institute affairs about ten years ago and has had wide experience in matters relating to Institute administration.

With this background he will no doubt be an asset to the activities of the division.

#### Central Coast Branch

The monthly meeting of the Central Coast Branch of the New South Wales Division held at Gosford on Friday evening, August 19, was very well attended by members and visitors. A feature of the evening was a talk by the president of the Branch, Lindsay Douglas, VK2ON. Lindsay had just returned from a trip

overseas and his talk, dealing with personalities in the amateur radio service he met during his travels as well as places of interest, was illustrated by colour slides.

In addition to a description by Lindsay of some of the equipment seen during his trip, three members gave a lecture on pieces of equipment that they had brought to the meeting.

The committee investigating the procurement of more suitable club rooms reported on the progress made in obtaining new premises. Following a discussion on the committee's recommendation, it was decided to hold the next meeting at the Kariong Progress Hall.

The publicity officer of the Branch is Bill Smith, VK2TS, who will be pleased to give interested persons details of Branch activities. These can be obtained by writing to his address: R.M.B. 100A, Wisemans Ferry Road, Mangrove Mountain, 2251.

#### Blue Mountains Branch

The Annual Field Day of the Blue Mountains Branch of the New South Wales Division is to be held in the Picnic Grounds surrounding the Lawson Swimming Pool at Lawson on Sunday, November 19, 1968.

A very interesting program is planned. This will include:

- 10.00 a.m. Registration.
- 10.00 a.m.-11.00 a.m. 144MHz Scramble.
- 11.30 a.m. 144MHz Hidden Transmitter Hunt for Pedestrians.
- 12 noon - 1 p.m. Lunch.
- 1.00 p.m. - 2.00 p.m. 144MHz Hidden

# MEET THE SOLID STATE STEREO SONY TC-230W



## SPECIFICATIONS

Reels:	7" or smaller
Tape speed:	7½ ips, 3½ ips, 1½ ips
Recording system:	4-track stereo/mono recording and playback
Power requirements:	AC 60W 100, 110, 117, 125, 220, 240V; 50, 60 cps
Frequency response:	40-18,000 cps at 7½ ips 40-12,000 at 3½ ips; 40-6,000 cps at 1½ ips
Signal-to-noise ratio:	Better than 46 dB
Flutter and wow:	Less than 0.17% at 7½ ips Less than 0.3% at 3½ ips Less than 0.4% at 1½ ips
Harmonic distortion:	Less than 3% at 0 dB line output
Level indication:	Two VU meters
Recording time:	4-track stereo; 1.5 hr at 7½ ips; (with 550m tape) 3 hr at 3½ ips; 6 hr at 1½ ips
Power output:	4W x 2
Inputs:	Rec/PB connector— Impedance approx. 10K ohms Microphone inputs— Sensitivity—75 dB (0.14 mV) Impedance 600 ohms Phono inputs—Sensitivity—52.5 dB (2mV) Tuner (auxiliary) inputs Sensitivity—25dB; (44mV) Impedance approx. 10K ohms
Outputs:	Line outputs—Output Level PB 3 dB (1.1V) Rec. 1 dB (0.87V) Load impedance 10K ohms External speaker outputs—11.3 dB (2.83V) Impedance 8 ohms Headphone outputs—Impedance 8 ohms or more Rec/PB connector—Impedance approx. 3.5K ohms
Heads:	PP30—4202LN, EF18—2902H
Transistors:	2SC402 x 10, 2SC401 x 8, 2SD28 x 4, 2SB383 x 2
Diodes:	FR-1P x 2, IT22 x 2
Dimensions:	15½" (W) x 7½" (H) x 13½" (D)
Weight:	22 lb
Accessories:	2 microphones (F-45); Empty reel (R-7A); Connection cord (RK-56); Head cleaning ribbon Motor pulley Pre-recorded 5" reel demonstration tape Telephone pickup (TP-4S); Microphone mixer (MX-6S); Stereo headset (DR-3A, DR-3C)
Optional accessories:	

## Model TC-230W

Call it an integrated stereo amplifier with a built-in tape recorder, or a tape recorder with a built-in stereo amplifier. Either way, you have the most advanced compact stereo tape and music system to ever come along. In addition to a complete 4-track stereo/monophonic tape recording and playback system, this versatile TC-230W features the exclusive stereo control centre consisting of a multiple input stereo preamplifier and 4W x 2 stereo power amplifier. Just connect your tuner, stereo changer or turntable to the TC-230W, and you are free to choose instantly, with just a flick of the selector switch on the front panel, either listening or recording source from any of the connected components. The set is handsomely encased in an oiled walnut cabinet and is perfectly compatible with the Sony speaker model SS103 (extra). List price, \$375.

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Please send information on Sony Tape Recorders, and name of nearest Sony retailer.

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P'CODE

S58/FP/E10

Transmitter Hunt for Mobiles.  
2.30 p.m. - 3.30 p.m. 146MHz (FM) and 53.866MHz (AM) Talk-in Transmitter Hunt. No beams will be permitted in this event.

#### 4 p.m. Presentation of Prizes.

There will also be a number of events for the ladies, details of which were being finalised at the time these notes were being prepared.

Members of the Branch extend a cordial invitation to all amateur operators, their families and friends to join them at Lawson for a pleasant day in the mountains. No prior booking is necessary.

The Branch meets on the third Friday of each month in the club rooms at the old Council Chambers, Lawson, just across the railway line from the Western Highway near Lawson Railway station.

Information on the activities in the Branch can be obtained by writing to the Secretary, Dan Clift, VK2ZDE, 152 Rusden Road, Blaxland, 2774, N.S.W.

## WESTERN AUSTRALIA

The new committee of the West Australian VHF Group comprises the following members.

Patron: F. W. Dawson.

President: John Lewis VK6ZGL.

Vice-president: Harry Pride VK6HP.

Secretary: Edwin Smith VK6ZAN.

Treasurer: Cedric Woods VK6CD.

## W.I.A. YOUTH RADIO SCHEME

Awards won by members of the Westlakes Radio Club were presented to them at the Hunter Branch W.I.A. meeting held at the Newcastle Technical College, Tighe's Hill. The presentation was made by the Branch President, Rodney Prout, VK2CN, who congratulated the ten boys concerned on their achievements and wished them every success in the hobby of amateur radio. Three of the members, Jan Oosterveen, VK2BJO, David Frazer, VK2ZYK and Ian Miller, VK2ZIS, gained Senior Radio Certificates, being the second, third and fourth Y.R.S. members in N.S.W. to gain this high award.

Another club member, Greg Cross, has gained his limited licence and is operating under the call sign VK2ZZZ. Joe Waugh has been notified that he has passed the Morse code test and is awaiting the issue of a call sign.

The Westlakes Radio Club has the distinction of having trained more school pupil radio amateurs than any other Club or organisation in Australia.

#### Maitland Radio Club

More than 80 persons attended the C.W.A. Hall, East Maitland, on Friday evening, August 23, for a screening by Club Patron, Dr R. H. K. McKerihan, of colour slides taken on his trip overseas. Also shown was a short film of Bull Fights in Mexico City. The evening was a generous gesture by Dr McKerihan to assist the club to raise funds for the new club house.

As an instructor for the incoming District Governors in Rotary International, Dr McKerihan, during his overseas trip, photographed many points of interest in the Middle East, Mediterranean islands, Europe, London, Canada, U.S.A. and Mexico. The appreciative audience also enjoyed an excellent supper provided by the Ladies' Social Committee.

The interest shown in the club by public-spirited members of the community is very much appreciated by the Club Management Committee and members.

The plans for the club building have been approved by the Maitland City Council and it is expected that the contractor will have the exterior completed by the end of September. Members will then fit partitions and other fittings. When

Committee: Neville Chamberlain, Wayne Dowie VK6ZDD, Tom Berg VK6ZAF.

Bulletin Editor: Harry Pride VK6HP. Technical Editor: Tom Berg VK6ZAF. Bulletin Circulation: Roy Chamberlain VK6RY, Glen Hunter VK6ZFH, Bob Pine VK6ZFY.

Broadcast Officer: Kevin Bicknell VK6ZCB.

Assisted by: Don Graham VK6HK. OSCAR Co-ordinator: Don Graham VK6HK.

VHF Records Officer: Rollo Everingham VK6BO.

Q.S.L. Officer: Laurie Jessop VK6ZEA.

Press Correspondent: Percy Beacher VK6ZDC.

Beacon Officer: Tony Stanicic VK6ZDT.

Auditors: John Kitchin VK6TU, Ray Campbell VK6KU.

Club station VK6VF c/- E. E. Cook VK6AW.

The station operates as a beacon with automatic CW identification — VK6VF — with approximate 4 seconds key down position between call signs.

6 Meter Beacon — 52.006MHz

2 Meter Beacon — 145MHz

By arrangement — 432.59MHz

The Group meets on the fourth Monday in each month in the D.C.A. Workshops, 86 Guilford Road, Maylands, at 8 p.m. Membership subscription \$2.50 per annum.

completed, the building will provide a lecture room and a communications centre as well as a general club room. Equipment for the communications centre is being built by members at weekends, in the club workshop.

Donations have been received for the building fund from many interested persons and organisations.

Recently, members who were candidates for the Y.R.S. Intermediate Certificate attended a lecture on the principles of tape recording, by club president Kev Watson, VK2ZKW. Kev is well versed in this field and has successfully constructed a home-built recorder.

The "Maitland Radio Club News" editor, Bill Plant, VK2AMM, has received messages of congratulations on the standard of the magazine. These came from the secretary of the New South Wales Division of the W.I.A.; Jack Flynn, secretary of the Y.R.S.; and the public relations officer of the Ipswich and District Radio Club. Special mention was made of the articles dealing with crystal sets and printed circuits.

Trevor Watson, the club's QSL officer, reports that shortwave listening is very popular among members. The most active in this field are Tony Martin, Mathew Ingle, Allan Germon and Garry Watson, all with a large number of DX stations to their credit. Another keen club member is Ian Goodman, who was presented with his Elementary Certificate at the film night.

#### SOUTH AUSTRALIA

The Elizabeth Amateur Radio Club has a new Youth Radio Officer in the person of Bob Anderson. This position was previously held by Allan Dunn, who is now the State Secretary of the scheme and has also been elected President of the Elizabeth Radio Club.

All registered clubs in South Australia are receiving a complimentary copy of the Division's Journal each alternate month. Any club not receiving their copy should advise the state secretary.

The Y.R.S. net is on the air on the first Friday of each month at 2000 hours S.A. time. The frequency is around 3625KHz. All clubs and interested stations are invited to join the net.

(Continued on Page 144)

## UNITED TRADE SALES

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Tunable 108-136Mhz Aircraft Band.  
IF in Broadcast Band. Battery incl.  
\$14.40 inc. tax

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2 KHz Dial Calibrations. Usable to  
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Employs 4-807s in Parallel. Inbuilt 12v  
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Price, complete with Ant Tuning Unit  
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QS150/15 50c ea., VR150/30 75c ea.  
or 3 for \$2, VR105/30 75c ea. or  
3 for \$2, 6AM6 50c ea., QB2/250  
Philips (813). New in sealed cartons.  
Current manufacture, \$7 ea.

#### PERSPEX OPTICAL QUALITY

New shipment arrived. 16 x 4 x 1/8.  
30c per sheet.

#### STAR ST700 SSB AMATEUR BAND TRANSMITTER

3.4-29.7 Mhz in 7 Bands. 455 KHz  
Mechanical Filter for SSB. 250W PEP,  
VOX, PTT, ALC. Internal Sidetone  
Osc. for CW. 30 KHz per turn Tuning  
Rate. Selectable USB/LSB. Break in  
Keying for CW (no relay chatter or  
clipped CW). SR 700A and ST 700  
Combine for Transceive Operation while  
still maintaining separate Trans-Rec  
Facilities. ST700—\$519.50.

#### STAR 700A SSB AMATEUR BAND RECEIVER

3.4-29.7 Mhz in 7 Bands. Triple Con-  
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lators. Selectable USB/LSB. Variable  
Threshold Noise Limiter. Selectivity  
0.5, 1.2, 2.4, 4.0 KHz at 6db. 1 KHz  
Direct Dial Read-out. Sensitivity 0.5 uV,  
for 6db/S/Noise on SSB. 30 KHz per  
turn Tuning Rate. SR 700A—\$461.50.

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CT500

### C.T.330 20K. OPV

D.C. Volts 6, 6, 30, 120, 600, 1,200, 3,000, 6,000. A.C. Volts 6, 30, 120, 600, 1,200. D.C. Current .06-6, 60, 600mA. Resistance, 6K, 600K, 6meg., 60meg., D.B. minus 20 to plus 62. 5 Ranges. Specially suitable for transistor use.

**\$15.95**

### C.T.500 20K.OPV

D.C. Volts, 2.5, 10, 50, 250, 500, 1,000. A.C. Volts, 10, 50, 250, 500, 1,000. D.C. Current, .05, 5.50, 500mA. Resistance, 12K, 120K, 1.2meg., 12meg. D.B. minus 20 to plus 62.

**\$12.75**

### KAMODEN—100B

100,000 O.P.V.  
D.C. Volts, .5, 2.5, 10.50, 250, 500, 1,000. A.C. Volts, 10, 50, 250, 500, 1,000. D.C. Current, .05, 5.50, 500mA. Resistance, 12K, 120K, 1.2meg., 12meg. D.B. minus 20 to plus 62. 5 Ranges.

**\$28.75 Post \$1.00**

### P.T.34 1000.OPV

D.C. Volts, 0, 10, 50, 250, 500, 1,000. A.C. Volts, 0, 10, 50, 250, 500, 1,000. M.A. 1-100-500 RESISTANCE.  
**\$5.25 Post 50c**

### 200H 20K.OPV

D.C. Volts, 5, 25, 50, 250, 500, 2,500. A.C. Volts, 10, 50, 100, 500, 1,000. D.C. Current, 50mA, 2.5, 250mA. Resistance, 6K, 600K. Capacitance, 2 D.B. Ranges.

**\$10.50 Post 50c**

ALL PRICES NET, INC. S.TAX.

### PANEL METERS



EDGE METERS, 1mA.  
Scaled V U.S.

Tuning Stereo Bal. **\$2.50**.  
A FULL RANGE OF UNITS.  
85 Types. 1 1/4in to 3 1/2in.  
FROM **\$3.**  
Send for full list.

### HI-FIDELITY TWIN CONE SPEAKERS

Aust. made, 8 or 16 ohms.  
6in .. \$9.00 12in .. \$11.75  
8in .. \$7.50 Postage:  
8in .. \$9.00 N.S.W. 50c.  
10in .. \$10.75 Interstate 80c.

### AMPLIFIERS Public Address Range 240V-AC



MINIATURE P.A. AMPLIFIER.  
15 WATTS OUTPUT.  
Multi Match Ferguson O.P. transformer input for crystal mike and pick-up with electronic mixing.  
P.P. EL.84 output .. \$39.50  
30 Watt. As above, EL.34 .. \$33.50  
P.P. .. \$3.50  
40 Watt. As above, EL.34 .. \$79.50  
P.P. .. \$7.50  
60 Watt. As above, 6DQ6 .. \$98.50  
P.P. .. \$9.50  
LINE CIR VOICE COIL  
TRANSFORMERS

MULLARD HI-FI RANGE  
5/10 with pre amp base and treble boost. Ultra Linear output \$43.50  
5/20in. As above .. \$65.50

### P. A. SPEAKERS

8 WATT  
8in Units in Waterproof Projection Horns.  
15 Ohm Voice Coils.

**\$14.50**  
In Double Ended Flares.  
Dualateral Coverage.

**\$16.50**  
Line Output Transformers to suit.  
\$1.75 extra.

### DYNAMIC MICROPHONES

Model DM 108.  
Imp. 50K with Switch.  
Freq. Response  
100-10,000 c/s.

**\$11.75**  
Model DM-401  
with switch,

**\$8.75**  
Floor Model MIC  
Stand 2 Section  
Adjustable. Heavyweight.

**\$11.75**  
Table Model.  
**\$3.50**

9in Goose Neck, \$5.

### 4 CHANNEL TRANSISTORISED MICROPHONE MIXER

Specs. High Imp. Input. Gain, Approx. 3DB. Max. Input sig. 1 volt max. output sig. 1-3-volt noise ratio —60DB. 9-volt operation.

**\$9.75**

### TACHOMETERS



Mullard ACE, scaled for 5.7 or 9K. .... \$20.75  
With Dwell Angle .... \$23.75  
**OHNAR**

240-degree Circular Movement.  
Scaled 6K or 8K or 8K. \$24.75  
Standard Scale, 6 or 8K. \$19.75  
Postage N.S.W. 50c. Interstate 75c

### LOUD HAILER gets your message over LOUD and CLEAR

• Outdoor Sports • Clubs • Fêtes • Clubs' Childrens' Parties  
• Fairs • Building Sites • Amusement Parks • ANYWHERE  
You Want To Be Heard. Battery-operated—self-contained unit.  
COMPLETE with extension microphone lead ONLY \$59.00



### REVERBERATION UNITS

Latest design to suit organs, stereo, guitar, any hi-fi equipment.

**\$5.75**  
Post 35c.

### CO-AXIAL SPEAKERS C.S.-20. 8"

V.C. 16 ohm. Cross over, 3,000 cycle. Frequency range 40 to 20,000 cycles.

Rated 8 Watts.

**\$15.95**  
12in 20 Watt.  
As Above.  
**\$27.75**

### HORN TWEETER CT-3

2,000-20,000 Response.  
20 Watts Power.  
Sensitivity 110 dbw.  
Weight 1 1/4lb.

**\$8.95**

### STEREO RECORD CHANGERS

Latest Model, 4-speed.

**\$28.75**

De Luxe Model. Fully machined and balanced. Heavyweight turntable. Ceramic cartridge.

**\$34.00**

Post N.S.W. \$1.25. Interstate \$1.75. De Luxe Model with mechanical cueing device. Calibrated stylus. Pressure control. Adjustable counter balance.

Two spindles.

**\$46.50**

### ELAC 190

4-Speed Changers, Ceramic pick-up  
**\$27.50**



### HI-FI STEREO HEADPHONES

8-OHM.  
Range 25c to 17K.c.  
**\$9.75**  
Post 35c.

### SIGNAL GENERATOR

Deluxe Model TE-20D.  
Freq. range 120 KC-500 Mcs.  
7 Bands. Accuracy 2 per cent.  
Output 8V. Provision for Xtal.  
Suitable for self calibration Marker generator. Printed circuit.

TE.20 \$25.50.  
V.A.C.  
Post.. N.S.W. 75c. Interstate \$1.25.  
LEADER L. SG. 11.  
\$31.75.

### V.T.V.M. MODEL TE-40 MILLIVOLTER

Spec. AC.V. Inv.—300 Vrms. 10 ranges. Accuracy 5 cps—1 2mc, plus-minus 2db. 20 cps-1 mc, plus-minus 1db. 20 cps-250 KC., plus-minus 0.2db.  
dB. Scale: 40-30-20-10.0, 10.20, 30.40, 50 dBm. 240 V.A.C.

**\$47.50**

### MODEL TE-65 V.T.V.M.

DC. V. 0-1.5-5-15-50-150-500-1.500 V. Rms. AC.V. 0-1.5-5-15-50-500-1.500 V. Rms. 0-1.4-4-14-40-140-400-1,400-4,000 V. P.P.  
Resistance RX10,100, .1K, .10K, .100K, 1M, 10M. Decibel—10db, minus-plus 65db. 240 V.A.C.

**\$42.50**

TECH. P.V. 58. \$40.50.

### ORGAN KEYBOARDS

49 Note. Complete with  
Switching System.

**\$72.00**

13 Note Pedal Claviers,  
complete with Switches.

**\$39.95**

Special: Semi-finished Stromberg  
Organ Cabinets to suit above.

**\$19.50**

Organ Stools .. \$14.50

### NEW SPEAKER SPECIALS

8 or 15 ohms.  
2in .. \$2.75 5in x 3in \$3.30  
2 1/4in .. \$2.75 6in x 4in \$3.50  
2 3/4in .. \$2.85 7in x 5in \$4.25  
80mm .. \$2.85 9in x 6in \$5.95  
3 1/2in .. \$2.95 Postage:  
4in .. \$2.95 N.S.W. 25c.  
5 1/4in .. \$3.20 Interstate 40c.

### NEW RECORDING TAPE

Most popular brand.

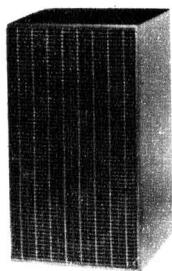
3in	Correspondence	....	50c
3in	Mylar L.P.	300ft	\$1.05
3 1/4in	Mylar D.P.	600ft	\$1.25
5in	Mylar L.P.	900ft	\$2.50
5in	Mylar D.P.	1,200ft	\$3.15
5 3/4in	Mylar L.P.	1,200ft	\$3.15
5 3/4in	Mylar D.P.	1,800ft	\$4.70
7in	Mylar L.P.	1,800ft	\$4.70
7in	Mylar D.P.	2,400ft	\$6.25
7in	Mylar T.P.	3,600ft	\$10.00
7in	P.V.C.	1,200ft	\$2.50
	Postage		
	N.S.W. 15c.		
	Postage Interstate 25c.		

## MULLARD MAGNAVOX

### BOOKSHELF ENCLOSURE

Maple, Teak or Walnut  
Complete \$24.75  
SUPER BOOKSHELF  
\$36.75.

Post: N.S.W. 50c. Interstate \$1.00.  
CABINETS ONLY  
R. H. BOOKSHELVES \$11.50  
MULLARD \$10.95  
BOOKSHELF UNITS  
6in 8in 10in 12in  
\$27.75 \$33.50 \$35.50 \$36.50



## GUITAR AMPLIFIERS

10-Watt, Two-Channel, with Twin Cone Speaker ... \$33.55  
14-Watt, 4 Inputs, Bass and Treble Boost, 2 Twin-Cone Speakers, \$63  
17-Watt, Four-Channel, Bass and Treble Boost, Two Twin-cone Speakers ... \$76.25

### 35 WATT

4-Channel, Bass and Treble Boost, 4 Twin-Cone Speakers ... \$109.05  
Vibrato with foot control and 2 preset controls for frequency and intensity. \$10.50 extra on above models.

### 14 plus 14 WATT

With Reverberation. May be used as 28 Watt or as 14 Watt plus 14 Watt Reverb. Two 9 x 6 Woofer Speakers. Two 9 x 6 Twin-Cone Speakers. 4 Channels. Bass and Treble Boost. Foot Vibrato control included.

**\$163.50**

### SLAP BASS OR BASS GUITAR 40-WATT AMPLIFIER

4 Input Channels, Bass and Treble Boost. Two 12in Radial Beam Speakers. Perfect reproduction on 20 cycles.

**\$159.75**

## PIGGY BACK GUITAR AMPLIFIER

30 Watt ... \$79.75  
45 Watt ... \$99.75  
60 Watt ... \$119.75  
4 Inputs. Bass and Treble Boost. Vibrato if required, \$10.50 extra.

## ELECTRIC GUITAR

Pickup Units ... \$8.75  
Accordion Pickup Units ... \$8.75  
Harmonica Pickup Units ... \$1.95  
Post, N.S.W. 40c; Interstate, 75c.

## FUZZ BOX

FUZZ BOX E. AND A. AUG. WIRED AND TESTED. \$15.  
Post, 75c.

## REVERB UNIT

COMPLETE with AMPLIFIER. E.A. October issue. Kitset \$39.95. Wired and tested, \$41.95.

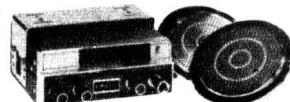
## 15-INCH HI-POWER SPEAKER

30 and 50-WATT RMS. Specially designed for Guitar, Organ, Bass, etc. \$59.50

## INTER. COM. UNITS

2 Station Transistorised \$11.50  
4 Station, including Master \$20.25

## "MYERS" AUTOMOBILE STEREO TAPE PLAYER



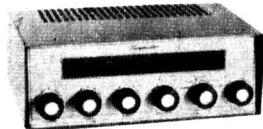
12 VDC, 1 amp operation. Size 3, 4 and 8 track cartridges can be played. Automatic starting and selecting. 12 silicon transistors. Freq. response, 70-10,000 cps. Tape speed 3 1/4 per sec.

**\$99.50**

240 VAC model available, includes P.U. or radio input.

**\$99.50**

## PLAYMASTER 106 AND 107



Feb. and March Elect. Aust.

**106**

WIRED AND TESTED **\$88.75**

**107**

WIRED AND TESTED **\$79.00**

## CHANGER PLATFORMS

Teak Finish.

## PERSPEX DOMES

Fits All Current Models.

## MINIBOX

## SPEAKER CABINETS

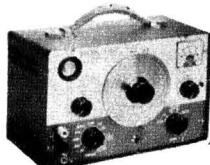
Teak or Walnut Finish.

Takes Magnavox 6in Speaker and 3in Tweeter.

All One Price

**\$7.50 EACH**

Post, N.S.W. 65c., Interstate \$1.00.



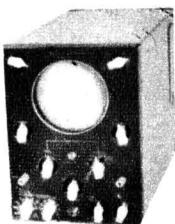
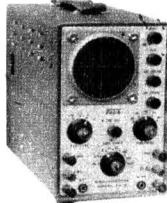
## T. E. 46 RESISTANCE-CAPACITANCE

Bridge and Analyser. Capacity 20 pf to 2,000 mfd. Resistance 2 ohm to 200 megs. Also tests power factor, leakage, impedance, transformer ratio, insulation resistance to 200 megs. at 600V.

Indications by eye and meter.

**\$47.75**

## TEST EQUIPMENT



## WIDE BAND OSCILLOSCOPE

5 Meg. Bandwidth Push-pull vertical and horizontal Amplifiers, 8 positions, high sensitivity vertical Amplifier, Frequency Compensated on all positions. Calibrated .02 to 600 volt. Hard time base, 20 cycles to 75K. Latest American R.C.A. circuitry. Complete with probe.

**3-inch \$99.75; 5-inch \$111.50**

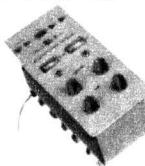
## PLAYMASTER 115

The new solid state Stereo-Amplifier. April issue.  
Wired and tested ... \$164.00  
Kit Set ... \$90.00  
Pre-amp to suit magnetic cartridge ... \$12.00



## PLAYMASTER 118

KITSETS \$79.75.  
Wired and tested, \$89.75.  
Fitted with Pre-Amp to suit Magnetic Cartridge. \$12.00 extra



## 119 STEREO TAPE ADAPTER

Suits all Playmaster Stereo amplifiers and others that accept crystal P.U.

Kitset ... \$79.00  
Wired and tested ... \$96.00

## TAPE PLAYBACK KITSET

BSR deck with parts for transistor pre-amp and circuit.

**\$30.00**

Post \$1.25 N.S.W., \$2.00 Interstate.

Easy to build. Mi-Fi quality.

## TAPE DECKS B.S.R.

2 Track, 3 1/4 i.p.s.

**\$25.50**

4 Track, 3 Speed Stereo.

**\$41.50**

## VALVE TESTER

Tests all valves, diodes, rectifiers, checking filaments, shorts, Merit on direct reading. Good-bad meter. Complete with tube chart.

**\$26.75**

Post., N.S.W., 25c; I.state, \$1.25.

## T.E. 50-99-5011

Checks, Nu Vistas, Compactrons, etc.

**\$34.25**

Post: N.S.W. 25c; I.state \$1.25.

## G.D.O. UNITS

Leader \$10. 6-Band, 2 Mcs to 260 Meg Nuvistorised, 240 V.A.C. Operation. Modulated. Calibration. Accuracy 2 per cent.

**\$41.50**

T.E. 18 Lafayette, 8 Bands, 360 K.C. to 260 Megs. 240 V.A.C. operation.

**\$39.50**

Post., N.S.W., 50c; I.state, 75c. T.E. 15 Transistorised, 7 Band, 360 Kc to 270 Megs.

**\$34.75**

Post: N.S.W. 25c; I.state \$1.25.

## 240v A.C. POWERED SOLID STATE STEREO

T.S.135

18 Transistor. 15-watt per channel.

Inputs for Tape, Mag. P.U.

Ger. P.U. Radio Aux.

Freq. Range 30c to 20KC.

Max. Sensitivity 3 MV.

Speaker matching 4 to 15 ohms.

**\$78.00**

18 Transistor. 15-watt per channel.

Inputs for Tape, Mag. P.U.

Ger. P.U. Radio Aux.

Freq. Range 30c to 20KC.

Max. Sensitivity 3 MV.

Speaker matching 4 to 15 ohms.

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Ger. P.U. Radio Aux.

Freq. Range 30c to 20KC.

Max. Sensitivity 3 MV.

Speaker matching 4 to 15 ohms.

**\$78.00**

# TRIO

## COMMUNICATIONS RECEIVER

### 9R-59DE



- 4 BANDS COVERING 540 Kcs. TO 30 Mcs.
- TWO MECHANICAL FILTERS ENSURE MAXIMUM SELECTIVITY.
- PRODUCT DETECTOR FOR S.S.B. RECEPTION.
- AUTOMATIC NOISE LIMITER.
- LARGE TUNING AND BAND-SPREAD DIALS FOR ACCURATE TUNING.
- CALIBRATED ELECTRICAL BANDSPREAD.
- "S" METER AND B.F.O.
- 2 MICROVOLTS SENSITIVITY FOR 10 dB S/N RATIO.

**SPECIFICATIONS:**

**Frequency Range:** Band A—550-1600 Kcs.  
 Band B—1.6-4.8 Mcs.  
 Band C—4.8-14.5 Mcs.  
 Band D—10.5-30 Mcs.

**Calibrated Electrical Bandspread:**

80 and 40 metres—5 Kcs. per division.  
 20 and 15 metres—20 Kcs. per division.  
 10 metres—50 Kcs. per division.

**Antenna Input:** 50-400 ohms impedance.

**Audio Power Output:** 1.5 watts.

**Sensitivity:** 2  $\mu$ V for 10 dB S/N Ratio (at 10 Mcs.).

**Selectivity:**  $\pm 5$  Kcs. at  $-60$  dB ( $\pm 1.3$  Kcs. at  $-6$  dB).

When using the Mechanical Filter.

**BFO Frequency:** 455 Kcs.  $\pm 2.5$  Kcs.

**Speaker Output:** 4 or 8 ohms.

**PRICE: FOR/FOA SYDNEY: \$175.00**

CONSULT YOUR LOCAL RADIO DEALER, OR

MAIL THIS COUPON *today*

Please forward free illustrated literature and specifications on Trio equipment.

Name.....

376 EASTERN VALLEY WAY, ROSEVILLE, N.S.W.

Address..... Cables and Telegraphic Address: 'WESTELEC,'  
 Sydney. Phone: 40 1212

**Weston Electronics**  
 PTY LTD

(A unit of Jacoby Mitchell Holdings Ltd.)

## Jamboree-On-The-Air

The 11th Jamboree-on-the-Air will be held over the weekend, October 19 and 20, 1968, starting at 0001GMT on Saturday, 19th and ending at 2359GMT on Sunday, 20th.

This event, as in previous years, is not a contest but one which enables members of the Boy Scout organisations throughout the world to get a first-hand introduction to amateur radio and the facilities it offers for international communication between the peoples of the world.

Generally speaking the rules for the event remain unchanged and are as follows:

Objects: To let Scouts talk and listen to their brother Scouts — whether they be in the next town or in another country—and to learn about their activities, families and homes.

Rules: 1. Licence regulations must be strictly observed at all times.

2. Any part of the 48-hour period may be used.

3. Any authorised amateur frequency allocation may be used.

4. To take part, call "CQ Jamboree" or answer another station using this call. On CW use the call "CQ JAM."

5. Any authorised mode of transmission may be used.

6. This is not a contest; there are no prizes for the most contacts. A participation certificate is sent to anyone sending in a report, either through his Branch Organiser or to the National Organiser.

Reports: These should contain a list of stations contacted, showing call-signs, locations and Scout Groups represented, as well as notes on any interesting happenings, suggestions for next year's event. Details of portable stations set up especially for the weekend and copies of photographs may be included.

The one major change is that the Boy Scouts' World Bureau station VE3WSB, may not be operating. Following a directive from the 21st World Conference held in Seattle during August, 1967, the Boy Scouts' World Bureau was to be moved to Geneva, Switzerland, in May, 1968. Should it not be possible to have the Bureau established in time to have its own station in operation it is probable that the International Amateur Radio Club station 4U11TU will be made available for use during the J.O.T.A.

In a copy of the official report on the 10th Jamboree-on-the-Air compiled at the Boy Scouts' World Bureau, received from Noel Lynch, Australian National Organiser for J.O.T.A., several very interesting facts are recorded.

With due acknowledgement, sections of the report are quoted for the information of operators who have not had the opportunity to see the report.

A total of 72 countries participated, with Australia having the largest number of amateur stations participating. A total of 395 amateur stations participated in Australia giving a ratio of one station to every 280 Scouts. In South Africa, a total of 106 stations participated, with 400 Scouts per station.

The report contained reports from 23 countries and photographs of stations in operation around the world. Among the photographs were those of Australian stations, VK4QH Brisbane, the Headquarters Scout station in Queensland; VK8NO, Gove, Northern Territory; VK9BS, Port Moresby, New Guinea; and VK4ZWC Maritime Mobile, the Shorncliffe Sea Scouts operating on board the Invicta Trimaran, off Brisbane.

A total of 8,870 Scouts, Guides and visitors participated in Australia. The total number of contacts logged—within Australia 4,377; overseas 544.



# LISTENING AROUND THE WORLD

Art Cushen's monthly report on long-distance short-wave, television and broadcast band reception.

## Radio New Zealand's Twentieth Year

On September 26 Radio New Zealand celebrated its 20th year of operation, and considering the low power of 7,500 watts used, it is well received in the Pacific area.

Radio New Zealand receives more than 3000 letters a year and many of these are from outside the target area of the Pacific and Australia. Under favourable conditions the station receives reports from South-East Asia, Japan, North America, and Europe. Radio New Zealand relays NZBC National program from Wellington on weekdays and the 2ZB Wellington program on Sunday.

The present schedule of Radio New Zealand, Wellington, is as follows:

### To the Pacific

GMT	KHz
1700-1945	9520, 11780
2000-0545	15110
0600-0845	9540, 11780

### To Australia

2000-0545	17770
0900-1145	9520, 11820

Radio New Zealand's DX Session, Arthur Cushen's DX World, is on the air on the first Wednesday of each month at 0645 and 1030 GMT, and the following Saturday at 2345GMT. It is also carried on the NZBC all night National program, on the third Friday of each month at 1415GMT on 570, 640, 690, 760, 780KHz.

### Late News

AUSTRALIA: Radio Australia using 15140KHz 0900-1400 in place of 15390KHz. The new relay transmitter at Darwin now scheduled to open in November.

ECUADOR: HCJB Quito using 21495, 2300-2400GMT.

CHINA: Radio Peking opens in Spanish at 2400GMT on 21480KHz.

U.S.S.R.: Moscow using new 21725KHz channel in English 0700-0730GMT.

### SURVEY OF AMERICAN SIGNALS

The reception of signals from Central and South America around 0400 and again at 1000-1200GMT in the past month, continues to provide some very interesting DX. A summary of news compiled from notes from readers gives details of this information. Our thanks to Bob Padua, Melbourne, Vic, Dene Lynneberg, Wellington, N.Z. and other readers who have added their news to our own observations.

GUATEMALA: A seldom heard station, Radio Santa Cruz at Santa Cruz del Quiche, has been heard at 1200GMT to fade out at 1235GMT. The station announces and has time checks between each musical item. Frequency is 4872 and the call sign TGQH.

HAITI: Radio Haiti, 4VPJ on 6195KHz, has been heard opening at 1030GMT, with a French program and popular music. The station suffers some interference from Radio Cali in Colombia which also opens at 1030GMT. Radio Hiti has cuckoo clock notes between

recordings and fadeout is about 1115GMT.

MARTINIQUE: Fort de France on 3315KHz has been observed at 1000GMT opening with "La Marseillaise" and continuing with a musical program. The earlier sign-on in French has made reception possible. Radio Martinique is a relay unit of the ORTF network.

VENEZUELA: Several signals in the 902-metre band have been heard, and these include Radio Occidente on 3365KHz at 1000GMT, Radio Libertador on 3245KHz; Voz de Tigre on 3255KHz; Radio Monagas on 3325KHz; Radio Universidad on 3395KHz, all of which have been good in the period 1000-1100GMT.

ECUADOR: Ecuadorian signals have been noted from Radio Iris on 3372KHz at 1135GMT with Andean style music; Ondes Quevedanas on 3309KHz at 1130GMT with typical Ecuadorian music. A further signal, from Radio Zaracuay on 3390KHz is observed with local music programs at 1100GMT.

COLOMBIA: Radio Bucaramanga, HJGF, on 4845KHz has been heard at 1030GMT with a fair signal, but mixed with Malaysia. Radio Nacional de Colombia at Bogota on 6180KHz has been received from 1130GMT, and a further outlet on 4955KHz (which has been heard as high as 4962KHz) is being received at 1120GMT.

PERU: Radio Cuzco with the call OAX7A, using 6250KHz has been heard on Sunday to sign off; 0410 to as late as 0420GMT. Radio Huancayo, on 5955KHz has world news in Spanish at 1145GMT.

LOJA: A report in the New Zealand DX Times from a listener in Santiago, Chile, states that a new station located at Loja, Ecuador, is operating on 4735 KHz. The station is using the slogan "Radio Luz y Vida" and was officially opened on July 21.

Over the past few weeks we have been hearing "Radio el Progreso" located at Loja on 4735KHz. This station has been operating on this frequency for some months, and we can only presume that these two stations share the one transmitter. Radio el Progreso has been heard in New Zealand to as late as 0700GMT with typical Ecuadorian music and request numbers being played for listeners.

### FEBC USING 21515KHz

The Far East Broadcasting Company in Manila is now using the 13 meter band and is well received on 21515KHz. The English service is broadcast to Australia and New Zealand 0100-0230, 0300-0630 and 0900-0945GMT. Best reception in New Zealand has been around 0530GMT when the station has been heard with its usual Gospel program. FEBC is also using 15440 and 17805 KHz at this time.

### TESTS FROM CYPRUS

The Cyprus Broadcasting Corporation has recently begun a series of tests for reception in Great Britain for Cypriots living in Britain. A 30KW transmitter is being used for the tests, and the trials are to determine the best frequency to beam a program to Britain. The programs are in Greek and English, with a different frequency used each day.

Transmissions are 1900-2100GMT; Monday 15245KHz; Tuesday 17760KHz; Wednesday 15260KHz; Thursday 17875KHz; Friday 1300-1505GMT on 15270KHz; Saturday 17760KHz; Sunday 17785KHz.

The station welcomes reception reports. Other frequencies which may be used are 9525, 9680, 11745, 11915KHz.

### ENGLISH FROM MOSCOW

Radio Moscow transmission to Australia and New Zealand is well received through its Siberian relay station. The schedule which is now in effect includes the use of two medium wave frequencies as well as short wave.

GMT	KHz
1100-1130	17820, 9750, 629
1130-1200	9750, 1475, 629
1230-1300	11690, 9750, 1475, 629
1330-1400	9610, 7280, 1475, 629

### RADIO VILNIUS, LITHUANIA

English transmissions from Radio Vilnius are at present providing good reception on several channels at 2230GMT Friday and Sunday only. The transmission is beamed to the British Isles and uses the Radio Moscow transmitters on short wave. This is particularly noticeable on 17700KHz, which concludes its transmission to Britain from Radio Moscow at 2228GMT, to open two minutes later at Radio Vilnius.

The present transmission schedule, includes programs at 2100 and 2230GMT. The first in on medium wave and one short wave channel, the second all on short wave.

2100-2230GMT: 665, 1106, 1556, 15440 KHz.  
2230-2330: 17700, 15200, 15130, 11950, 11775KHz.

The program opens with news and commentary, then music. Verification is by card and letter. Books on Lithuania are also sent to listeners.

### ENGLISH FROM WARSAW

The Polish Radio broadcasts English for listeners in Europe which also provides fair reception in the Pacific area at the following times:

GMT	KHz
0730-0800	11840, 11725, 9675, 9525
1830-1857	11815, 7125
1930-2000	11815, 9570, 7125
2030-2100	11815, 9570, 9540
2130-2155	11815, 7125
2230-2300	9540, 7285, 5995
2303-2330	818

### AFRICAN SIGNALS WELL RECEIVED

To summarise the signals from Africa this month, we list by country some of the most interesting compiled from information from readers and our own observations.



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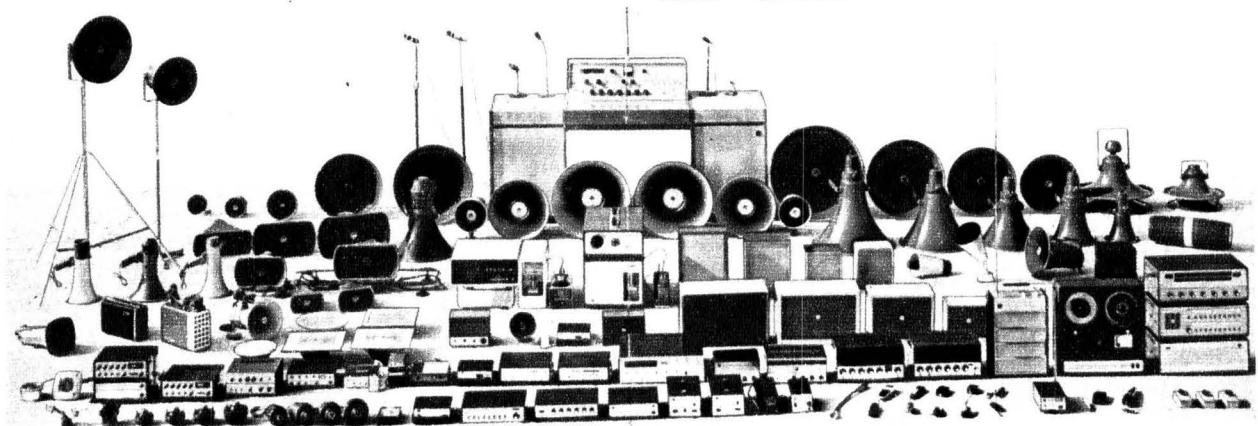
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**CAMEROONS:** The Federal Broadcast System in the Cameroons is heard over Radio Buea, on 3970KHz and has news in English from 1830GMT. At 1845GMT the program continues in French.

**SOUTH AFRICA:** Radio SABC, using 2346KHz from Johannesburg, has been heard with the same program (Afrikaans service) as 3940KHz at 1900GMT. English programs have been heard on 3965KHz at 2000GMT, and news in English at 2100GMT after time signal.

**NIGERIA:** Radio Nigeria at Lagos, is using the new channel of 3985KHz and heard at 0455GMT and at 0510GMT. Often has commercial programs. The station was also heard with news at 0600GMT, and again at 1845GMT before being blocked by the SIBS in the Solomons opening at 1900GMT on 3995KHz.

**MALI:** Radio Mali at Bamako, 4785-KHz, has been received with native music program at 2000GMT, and at times around 1830GMT.

**AZORES:** Radio Azores Ponta Delgada, with the call CSA97, uses 4865KHz and has a relay from Emisor Lisbon, in Portuguese at 2010GMT.

A list of signals from African stations on the 19M band has been supplied by Bill Hawthorn, Warrnambool, Victoria via Radio Australia. The signals are at present all being received at fair level.

15445 Radio Brazzaville, Congo, heard with news in French from Paris at 0500. The station is also heard in New Zealand with news in French at 0500 and English 0515-GMT.

15310 Radio Conakry, Guinea, has been received at 0610GMT with announcements in French.

15245 Kinshasa, Congo, noted at 0600-GMT with program of popular music and announcements in French.

15155 Voice of Nigeria, Lagos, has been received with news in English at 0630GMT with transmissions beamed to the United Kingdom.

15115 Radio Dakar, Senegal, heard with international service at 2230GMT with announcements in French and popular music.

#### BROADCASTS FROM SALISBURY

The Rhodesian Broadcasting Corporation operates to the following schedule in the General Service:

KHz	GMT
2425	1430-2100 (Saturday 2200, Sunday 0005)
3396	0355-0515, 1500-2100 (Saturday 2200, Sunday 0005)
6020	0355-1545
7285	0530-1445

#### African Service

KHz	GMT
3306	0330-0530, 1515-2010 (Saturday 2200)
5975	0430-1530
7175	0545-1500

#### PROGRAMS FROM BRAZZAVILLE

The ORTF relay station at Brazzaville, Congo, is now operating to the following revised schedule:

GMT	KHz
0500-0715	3232, 4795, 5970, 9730, 11725, 15445
1100-1200	11970, 15445
1100-1245	3232, 7105, 11710, 15190, 21500
1300-1400	17785, 21550
1730-2050	3232, 5970, 7105, 9730, 11930, 15190

News in French: 0500, 0600, 0700, 1130, 1230, 1330, 1730, 1805, 1900, 2030. News in English: 0515, 0615, 1100, 1300, 1915. News in Portuguese: 1145, 1845.

# FLASHES FROM EVERYWHERE

## EUROPE

**FRANCE:** ORTF Paris now carries a program to Eastern Europe from 1630 to 2000GMT on 5955KHz, 9620 and 11845-KHz. The frequency 9620KHz has replaced 7180KHz. Programs are in Bulgarian, Polish, Romanian, Czechoslovak, Hungarian, and Serbo-Croatian. The transmissions in Bulgarian are still heavily jammed, according to the World Bulletin.

**GREECE:** Foreign language programs from Athens are now on 9605 and 970KHz with English at 1115, French 1118 to 1221GMT. On 7295 and 9605-KHz English is at 1410, French 1413 to 1416GMT. Further eight-minute sessions are carried in Turkish, Serbian, Albanian, Rumanian, Bulgarian. The Greek Prime Minister has announced the building of a short-wave centre at Thessaloniki with two 100KW transmitters.

## AFRICA

**SEYCHELLES:** The Far East Broadcasting Company of Manila, are at present constructing a 50KW relay station to beam programs to India, Pakistan and Ceylon, and this station is due to open in early 1969. A year later the station plans to use additional antennas for beams to Central and South Africa, when the work on the additional aerial system has been completed.

**MALAGASY:** The Malagasy Republic is testing a 100KW transmitter on the new channel of 17730KHz from 1330 to 1430GMT. The station carries only music and announcement in French and English. It asks for reports to be sent to Radio Malagasy, P.O. Box 442, Tananarive, Malagasy Republic. The reports, if possible, should be sent in French, as the station does not seem to reply to letters sent in English. They are often returned from Tananarive. The box number appears to confuse the Post Office when written in English.

**TANZANIA:** Radio Tanzania Dar es Salaam, has its international service on 15435KHz. The schedule is 1700-1900-GMT, English news at 1700 and 1800-GMT, and Portuguese at 1830GMT.

**ETHIOPIA:** Radio ETLF at Addis Ababa has added an English transmission 2000-2015 on 15420KHz beamed to West Africa. The present English schedule is:

GMT	KHz
0530-0555	11890
1130-1345	15315
1655-1710	6065
1930-2015	11895

**RHODESIA:** Rhodesia Broadcasting Corporation at Salisbury has dropped the use of 3251, 3975, 6020KHz, and is now on 3306, 3396, 7175, 7285KHz, according to Sweden Calling DXers.

**TCHAD:** Radiodiffusion National de Tchadienne, Fort Lamy, is using the following schedule according to verification card. Monday to Friday, 0430-0630 on 4905KHz and 1200-2130GMT on 7120 and 9615KHz. From 1600GMT the service is also carried on 4905KHz. Saturday the program is extended to 2300GMT. On Sunday the service is 0430-2130GMT on 7120, 9615KHz, with 4905KHz, 0430-0700 and 1600 to 2130-GMT. The old frequency of 11800KHz has been dropped.

**NIGER:** Radio Niger, at Niamey, broadcasts on 3260KHz (4KW), 5020KHz (4KW), 9585KHz (4KW), 11785KHz (30KW), 11875KHz (4KW) and the transmissions are Monday to Friday 0530-1330, 1700-2200GMT, and Saturday 0530-1330, 1500-2200GMT. On Sunday the service is 0700-0900, 1500-2200GMT.

**NIGERIA:** Benin City Radio in Nigeria has been received in New Zealand at fair level at 0600GMT when the station carries a news bulletin in English. At 0610GMT the program includes a commentary, and at 0615GMT light music. Signals on 4932KHz are fair at this time, with programs being relayed from Lagos. Reception is also possible in Australia, and signals have been observed at 2130GMT with an English program. At 0600GMT Lagos on 4990-KHz is also being received with English news, but its program at 0615-GMT is different from Benin City on 4932KHz.

**SUDAN:** Radio Omdurman is expected to open two new 120KW short wave transmitters this month to give it world-wide reception. At present Khartoum is received on 4994KHz at around 2000GMT with usual Arabic programming. Omdurman Radio has programs in English in its present schedule, but at times not suitable for reception here.

## ASIA

**NEPAL:** Kathmandu is continuing to test its new 100KW transmitter. The frequency of 9590KHz is still in use with English 1500-1510GMT, and a new channel 4795KHz at 1320 to 1620GMT. The station is still using the medium wave channel of 790KHz on a test basis, and is clear in this area after Singapore closes at 1630GMT.

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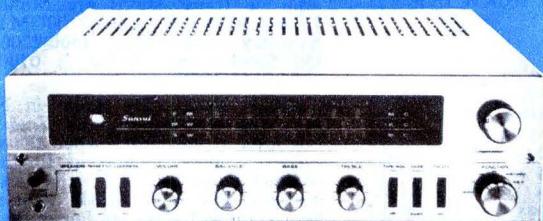
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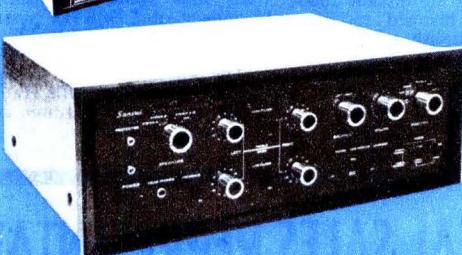
**MODEL 500A—AM/FM STEREO TUNER/AMPLIFIER**

Rated at 50 watts and with a frequency range of 20-20,000 Hz.  $\pm$  1½ dB., the 500A incorporates all desirable control features. Tuners include FM, FM Multiplex and AM. Input sensitivity is 2.5 mV. for magnetic pick-ups. A highly sensitive quality instrument.



**MODEL 3000A—SOLID STATE STEREO TUNER/AMPLIFIER**

Rated at 130 watts, the Model 3000 is a "deluxe" solid state unit in every sense of the word. 97 transistors and diodes. Response is 20-20,000 Hz.  $\pm$  1½ dB. FM, FM Multiplex and AM tuners. Highly sophisticated electronics are combined with functional control facilities. A superlative instrument.



**MODEL AU-777—SOLID STATE STEREO CONTROL AMPLIFIER**

With total power output of 70 watts, the AU-777 features all-silicon transistors in main amplifier and a frequency response of 20-70,000 Hz.  $\pm$  0.5 dB.,  $-1.5$  dB. Sensitivity for magnetic cartridges is 2 mV., for tape heads 1.3 mV. Every desirable control facility. An ideal stereo amplifier for sound enthusiasts.



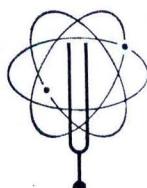
**MODEL 1000A—AM/FM STEREO TUNER/AMPLIFIER**

This powerful Sansui tuner/amplifier (over 100 watts of music power) features the latest Nuvistor Cascode and PP 7591 power tubes. Frequency response is 20-20,000 Hz.  $\pm$  1 dB. 21 valves. FM and AM tuners. Every conceivable control and facility.

SG EA/5/68

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**THAILAND:** The National Broadcasting Service now uses 100KW on 6070 and 115KHz, both transmitters being received to sign off at 1530GMT. The Thai overseas program from Bangkok is received on 1191KHz at 1030GMT with news on opening to 1045GMT when a music program follows.

**KUWAIT:** Radio Kuwait is reported to be continuing its tests on 21525KHz at 1800GMT using a 250KW transmitter. The station announces in English and Arabic, and gives fair reception, but is not heard daily. The new address is P.O. Box 397, Kuwait.

**PHILIPPINES:** The University of Philippines has been received on 7160KHz at fair level during its transmission 0900-1300GMT. The station confirms reception by letter, and gives the mailing address as, Radio DUH9, Voice of the State University, University of the Philippines, Quezon City, Philippines. The station operates 0900-1300GMT Monday to Saturday with transmissions mainly in English.

**MALAYSIA:** Radio Malaysia's home program has been received on 4790KHz at a good level to 1630GMT sign off. Programs before this time are in an Indian dialect. News in Malay is given at 1625GMT. Close is at 1630GMT with the Malaysian National Anthem. Another channel being received is 9660KHz. Radio Malaysia on this frequency suffers from interference from VLQ9 in Brisbane at 1100GMT.

**IRAQ:** Radio Iraq at Baghdad is on the air in Arabic as follows,

GMT	KHz
1300-1600	9555, 7180, 11785
1600-1930	9555, 7180, 11785, 6095.

English is broadcast from 1930 to 2020GMT on 6030 and 6095KHz. German, 2020-2100, and French, 2110-2200GMT, is carried on the same frequencies.

**ISRAEL:** The program of Kol Israel is now in English from 0500-0515, 1130-1200, 1830-1845, and in French 0515-0530, 1200-1230, 1845-1900GMT on 7189KHz as well as medium wave. This is the service for local reception, the External service from Jerusalem remains at 2115-2130 on 9009, 9725KHz, and to Africa 2015-2030GMT on 9009KHz.

**CHINA:** Radio Peking has extended its service to North America, 0500-0550, 0600-0655 and 0700-0755GMT, on 17650KHz. The station announces other channels from Peking as up to 0450GMT on 15060, 17795, 17680KHz. At 0300-0350GMT has been noted on the additional channels of 15105, 15170, 17645, 17655, 17715, 17790KHz. In New Zealand we have heard the 9780KHz channel very well at 0300GMT, another frequency which Peking does not list in its frequency announcements. Peking has also been noted in the 13 metre band, with French program 1930-2030GMT, on 21725 and 21750KHz.

**JORDAN:** Amman, in Jordan, has transmissions in Arabic to North Africa,

GMT	KHz	KW
0330-2300	11710	5
0330-0745, 1845-2300	7155	100
0930-1345	9530	100
1400-1830	7155	7.5

English programs are broadcast.

1030-1200	715	7.5
1200-1230	7155	7.5

Spanish transmissions.

1400-1830	9560	100
2330-0030	15170	100

**PHILIPPINES:** Reception in Europe of the South East Asia Radio Voice on the new frequency of 4980KHz is reported by Sweden Calling DXers. The station was heard at 2145GMT, with English religious programs. The SEARV

## NEW SCHEDULES OPERATING

### BROADCASTS FROM ANGOLA

With the introduction of some of the new 100KW transmitters, Emisora Official at Launda has altered its transmission schedule considerably. The broadcasts are now as follows:

KHz	KW	GMT.
3375	10	1700-0100 (Sunday 1500-0100, Saturday 1700-0300)
4820	100	0500-0745, 1855-1930, 1930-2400 (Sunday 2445)
7235	20/30	0500-1700 (Sunday 0630-1700)
11925	75	0800-1505, 1545-1700 (Sunday 0630-1505, 1545-1700)
11925	50	1505-1545
11925, 9535		1005-1045, 1605-1645 (French)
11925, 9535		1505-1545 (English)

### BROADCASTS FROM OSLO

Radio Norway, Oslo, is broadcasting on the following schedule until November 2, 1968. English programs are broadcast on Sunday for the last 30 minutes of each transmission.

Area	GMT	KHz
Australia, N.Z.	0700-0830	21730, 15175, 25900, 21655, 25730
India, Australia	1100-1230	7240, 21730, 25900, 21655, 25730
India, South Africa	1300-1430	21655, 25900, 25730, 17825, 21730
North and South America	1500-1630	25730, 25900, 21730, 17825, 21655
South and West Africa	1700-1830	21730, 21655, 25900, 25730, 15175
West Africa, S. America	1900-2030	15175, 17825, 21655, 25730, 21730
North and South America	2100-2230	15345, 21655, 17825, 15175
Central and S. America	2300-0030	15175, 11850, 11735,
Central and S. America	0100-0230	11850, 11735, 9550
North and South America	0300-0430	15175, 9645, 9550
Africa		

programs are still heard in this area at 1100GMT when using 15420KHz.

A new Voice of America relay station has been heard on 15155KHz at 1200GMT to 1630GMT. This is most likely the new 50KW relay at Tinang, which is to use 9615, 11715, 11930, 15155, 17765KHz.

**SAUDI ARABIA:** Signals from Jeddah in Saudi Arabia are being received on 15150 and 9670KHz from 1100 to 2200GMT. From 1600GMT the station uses the additional frequency of 11855KHz with Arabic programs. Radio Riyadh, uses 9720, 1195KHz from 0900 to 2230GMT.

**TAIWAN:** The Armed Forces Radio Services at Taipeh is received on two short wave frequencies, 7215 and 3990KHz. According to a report in a recent issue of Japanese Short Wave Club bulletin, reception in Japan has been observed at 1100GMT and all programs are in English. The station has news at 1100 to 1105GMT and is on the air 24 hours a day. The station identifies as "AFTN" and is also received on medium wave, 1560KHz, which also gives fair reception at 1600GMT.

### THE AMERICAS

**BRAZIL:** Radio Nacional de Brasilia has programs now for foreign listeners under the title of "Aqui Fala o Brazil." These transmissions are daily (except Sunday) 1235-1330, 2034-2130, 0000-0100GMT on 6065, 9665, 11720, 15445KHz.

**NETHERLANDS ANTILLES:** Trans World Radio at Bonaire is now opening to Europe at 2000GMT on 15435KHz, the English programs are heard at 2100GMT. Radio Nederlands is planning to test 200-300KW short wave transmitters this month, and will use 21 curtain type antenna systems.

**BOLIVIA:** Radio Emisora Bolivia, 4755KHz has confirmed our reception with a card and letter. The station is heard to sign off at 0500 and sign on at 1000GMT. The letter is from Teresa Badani L., Secretary, and the address is Velasco Galvarro 651, Casilla 525, Oruro, Bolivia. The card shows a map of Bolivia and photos of radio equipment.

**PERU:** New stations now operating in Peru are:

KHz
4800
4830
6045
3335
4902
4980
3250

Radio Nacional, Lima, now operates 10KW on 4985 and 17890KHz.

**ECUADOR:** The following new stations are now in operation in Ecuador.

KHz
5060
6010
6090

Radio Enepa, Zamora, 250 watts.

Radio Pastaz, Puyo, 2KW.

Radio Once de Noviembre, Catacunga, 500 watts.

According to Sweden Calling DXers, Ondas Azules, Cuenca, now has become Radio Splendid operating on 900 and 5025KHz, 3KW on each frequency. La Voz del Triunfo, Santo Domingo de los Colorados has moved from 3835 to 5955KHz with 1.5KW. Radio Ondas Ljanas 4950KHz has become Radio Luz y Vida. La Voz de Manabi, Portoviejo has moved from 4810 to 4785KHz. La Voz de Sasquili has changed to 4900KHz. Radio Paz y Bien, Ambato has moved from 2460 to 4820KHz. Another new station is La Radio Popular de Cuenca, heard on 4808KHz with Andean music. Signals have been heard in New Zealand after 0600GMT, but there is Morse on the channel. Station HCEH3, Loja, on 4735KHz has been heard with the slogan, "Radio El Progreso," on Sunday. Good signals (Spanish) are heard until after 0945GMT.

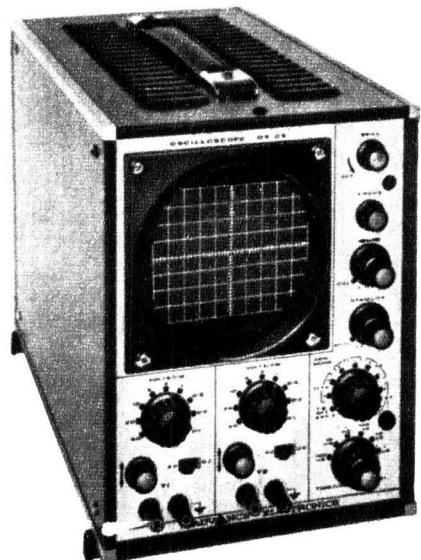
**DOMINICAN REPUBLIC:** Radio Santo Domingo is reported to have a program in English at 0245GMT, using 9505KHz. The station at 0300GMT announced as, "This is the International Voice of Santo Domingo" and gave 6090 and 3215KHz as being also in use, reports a North American listener.

The OS25 has set new standards for a low-cost, dual-trace oscilloscope. It is rugged, simple to operate and maintain and is attractively styled. Triggering facilities are unusually comprehensive for a low-cost instrument of this type and include internal triggering from either channel.

This oscilloscope has a vertical amplifier bandwidth from DC to 5 MHz with a maximum sensitivity of 100 mV/cm on each channel. The time base gives sweep speeds from 1 sec/cm to 0.5  $\mu$ s/cm using switched and fine controls. The operating mode best suited to the time base speed is automatically selected by the time base range switch; beam switching for the two slowest speeds and alternate sweep for the four highest speeds.

A bright clear display is obtained on a 5-inch helical PDA tube operating at a potential of 3 kV overall.

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## BROADCAST BAND NEWS

**INTERNATIONAL WATERS:** An off-shore station is soon to commence operation from a vessel off the south coast of England. The station, Radio Marina, will operate on 1157KHz with a popular music program, and on 770KHz with light music. Meanwhile, the Radio Veronica station off Holland which, in the past, has transmitted only in Dutch and French, is now to carry some English broadcasts.

**ISLE OF MAN:** Manx Radio, the only commercial radio on British soil, uses low power on 1295KHz from its transmitter at Douglas. It is reported that the station is planning a higher powered transmitter to enable its services to be received throughout Britain. The station's FM transmissions are received in the Douglas area and its medium wave service reaches the Liverpool area.

**SAUDI ARABIA:** The Saudi Arabian Broadcasting System at Riyadh, has moved its 1200KW transmitters to new channels on a test basis. The present frequency is 1130KHz, after testing on 1304 and 1322KHz, according to the "World Bulletin. A new station is Damman, on

NOTES FROM READERS should be sent to **ARTHUR CUSHEN**, 212 Earn St., Invercargill, N.Z. All times are GMT. Add 8 hours for Perth, 10 hours for Sydney and 12 hours for Wellington. All frequencies in KHz.

890KHz with 100KW, which relays the Riyadh program. Jeddah is now heard on 647KHz, in Arabic, at 1700, and in English at 1930GMT on 723KHz. The latter service in English has also been heard in New Zealand on 1594KHz, but our verification from the station lists the power as only 1000 watts, which we know is not correct. The 723 and 1594KHz stations rejoin the Arabic program at 2000GMT.

**HONG KONG:** Radio Hong Kong has cancelled its short wave service on 3940-KHz as plans are to install two 20KW transmitters for use on 640 and 860KHz.

### TOWER IMPROVES RECEPTION

To combat increasing man-made interference, including radiation from TV sets, a new 50-foot tower has been recently erected by our short wave correspondent, Art Cushen, of Invercargill, New Zealand. Mr. Cushen uses long wire Beverage aerials which cover a city block in three directions, and has found that an overall increase in height has significantly reduced the interference problem, particularly on the broadcast band.

Listeners may be acquainted with the television interference which occurs about every 15KHz along the broadcast band, and similar interference spoilt the reception of DX stations. The long aerials have a very definite directional pattern and, with push-button operation, reception can be switched from one direction to another very simply. Just how successful this is is shown by the example of listening to WVUV, American Samoa, 1120KHz, on one aerial, 4BC, Brisbane, Queensland, 1120KHz, on the other with no trace of interference.

The main tower is 33 feet high, of triangular lattice construction bolted to a concrete base. The top section is a single 21-foot steel mast which can be dropped into the mast proper so that the aerials can be serviced. By this means, no pulleys are necessary. The aerial is fed directly to the receiver. The mast is self-supporting and for those DXers who have the room, this type of aerial has many advantages. As well as the three long aerials which have an overall length of 600 feet, a short nondirectional aerial is slung from the tower for monitoring work. This short aerial enables reports to the B.B.C., London, and Radio Canada to be based on an aerial similar to that used by most listeners.

# ANSWERS TO CORRESPONDENTS

When writing to us:—

- Please give your name and full postal address, including the State and Postcode.
- Write the above information clearly or, for preference, print it in block letters. Your co-operation will facilitate delivery of replies by mail, where such are called for.

**SUITABLE TURNTABLE?** I have arranged to buy a Playmaster 115 amplifier with loudspeakers and I would like your advice regarding the purchase of a turntable. I am prepared to pay up to approx. \$130 and, in this price range, I have seen the Elac 40, Dual 1009, Goldring GL75, Labcraft 655L, and Thorens TD150. I was wondering whether you could make any recommendations and/or forward any data which would help me decide which would be the best for value. (B.J., Alderley, Qld.)

● We agree that this is a tantalising choice to have to make but, equally, you will appreciate the problems we would face if we accepted the responsibility of giving direct advice to a potential 100,000 readers as to the relative merits of directly competitive products. Nor can we possibly let ourselves get into the position of handling technical literature to do with such products. All we can do is to adopt the familiar role of a technical journal: Carry paid advertisements, publish release notes and reviews where products are submitted, and articles which educate readers along broad lines in the various fields. In the ultimate, it is up to readers to shop around to locate the product which most attracts them, at a suitable price and from a source which offers adequate back-up service. If particular reviews in the journal offer some assistance in making a choice, that is as it should be. In your case you are on fairly safe ground in that any one of the turntables is likely to meet the basic requirements — reliability, freedom from wow and flutter, acceptable mechanical characteristics. From here on, it is a matter of choosing the one which attracts you by reason of its appearance and physical layout.

**MODEL TRAIN:** Would it be possible to incorporate a circuit whereby a model train loco could have "overdrive" to pull excessive loads? (M.B., West Pymble, N.S.W.)

● The power available from an electric motor is closely related to the voltage fed to it. At the same time, a higher input voltage and heavier mechanical load will cause increased temperature rise in the motor and this is, in practice, what determines the voltage rating of any given motor and the load which can reasonably be placed upon it. This basic limitation cannot be overcome by any kind of circuitry.

**EARLIER RECEIVERS:** Have you any copies of the circuits for the old "Monty," "Little Jim" and "Little General" receivers of 1951 and 1952? I purchased the parts for these units years ago and then had to leave radio alone. I would now like to build up these units if possible as I still have most of the parts. Also, have you the plans for a small simple electric motor that could be fitted into a crystal set to show by turning the motor, that current does flow? What would the cost be for any of the above which are available? (L. B. Zillmere, Qld.)

● "Monty" was published in July, 1945; "Little Jim," in June, 1953; and "Little General," in July, 1951, and Sep-

tember, 1952. Circuits for each of these can be obtained through the Information Service for 20c each. We cannot supply details of an electric motor to operate from a crystal set. The power available from this simple device would be completely inadequate for the task.

**WIDER MARGINS:** I would like to suggest that the left-hand margin of "Electronics Australia" be widened to 4-inch to allow individual pages to be punched for filing in a loose-leaf folder. At the moment it is necessary to punch the top of the pages to avoid cutting into the articles. (T.Y., Hong Kong.)

● We can understand your problem but it would not be very practical to do as you suggest. The size of page, which is already narrower than standard quarto, is dictated by what is convenient and economical on high-speed presses and the reel sizes involved in printing other magazines. The only other way to increase margins would be to reduce type area and this would not be welcomed either by general readers or by advertisers.

**TAPE OPERATED REPLAY:** Recently you published an article and circuit for a tape operated relay (September, 1967). I started to read the article but, to my disappointment, I found that the system worked on light and not on sound. I have a 4-track tape recorder which I would like to couple to my slide projector using one channel for commentary and the other to operate the slide movement. I hope you will give this system some thought for a further article, or if not, I would very much appreciate a cir-

cuit if you could find time to arrange one for me. Keep up the good work with your magazine. (D. P., Colac, Vic.).

● We are sorry if the article disappointed you, but it was intended as a simple project usable with either 2-track or 4-track recorders and without any modification of the machine. You could adapt the basic design of this device by arranging for a tone pulse to be recorded on the spare channel such that when it was played on the recorder the tone would give an output pulse sufficient to trigger the thyristor operating the relay in turn. A short or long press of the button can be simulated by this type of unit by using light or sound pulses of varying length — the long pulses actually re-triggering the thyristor continually to hold the relay on for a long period.

**TUNER REQUIRED:** With reference to the Playmaster 120 Control Unit described in Volume 29, No. 11, will you please tell me where I could get a good tuning circuit using valves which could be used with this control unit. (A.W.M., Reynella, S.A.)

● We suggest that the Playmaster Program Source No. 3, from our October, 1965 issue, should be suitable for your requirements, provided you have a power amplifier capable of providing the 200V required for the HT line. This circuit uses a 6AE8 triode/pentode for the mixer, a 6BA6 in the IF stage and a diode detector. A 6BR5 "magic eye" tuning tube is optional. Details of this tuner can be obtained from the Inquiry Service on payment of the usual fee of 20c.

**LINE FILTER:** We have an electric car racing set which uses 240V mains via a step-down transformer. There is one problem; it causes static in the radio and TV set, and we are not allowed to use it. Can you advise on how to reduce this problem? I would also like to compliment you on your magazine and its reasonably low cost—most overseas electronics magazines

## "ELECTRONICS Australia" Information Service

As a service to readers "ELECTRONICS Australia" is able to offer: (1) Photographs, dye-line prints and other filed material to do with constructional projects and (2) A strictly limited degree of personalised assistance by mail or by reply through the columns of the magazine. Details are set out below:

**REPRINTS:** For a 20c fee, we will supply circuit data, as available from our files. The amount of data available varies but in no case does it include material additional to that already published in the magazine. For complicated projects involving material extracted from more than one issue, an extra fee may be requested. As a rule, requests for circuit data will be answered more speedily if the circuits are positively identified and the request is not complicated by questions requiring the attention of technical personnel. Where articles are not on file, we can usually provide a photostat copy at 20c PER PAGE.

**PHOTOGRAPHS, DYE-LINE PRINTS:** Original photographs are available for most of our projects, from 50c plus 8c postage for a 6in x 8in glossy print. In addition, metalwork dye-line prints are available for most projects for 50c each; these show dimensions and the positions of holes and cut-outs but give no details of wiring.

**BACK NUMBERS:** A fairly good selection is available. On issues up to 6 months old there is a surcharge of 5c. On issues from seven to 12 months old the surcharge is 10c. Over 12 months, it is 20c. Package and postage is 10c extra in all cases.

**REPLIES BY POST:** This provision is made primarily to assist readers in matters relating directly to articles and projects published in "ELECTRONICS Australia" within the last 12 months. Note, however, that we cannot provide lengthy answers, undertake special research or modifications to basic designs. A 20c query fee must be enclosed with letters to which a postal reply is required; the inclusion of an extra fee does not entitle correspondents to special consideration.

**OTHER QUERIES:** Technical queries which fall outside the scope of "Replies by Post" may be submitted without fee and may be answered through the columns of the magazine at the discretion of the Editor. Technical queries will not be answered by telephone.

**COMMERCIAL EQUIPMENT:** "ELECTRONICS Australia" does not maintain a directory of commercial equipment, or circuit files of commercial or ex-disposals receivers, amplifiers, etc. We are therefore not in a position to comment on proposed adaptation of such equipment, or on its general design. "ELECTRONICS Australia" does not deal in electronic components. Prices, specifications or other assistance must be sought from the appropriate advertiser or agent.

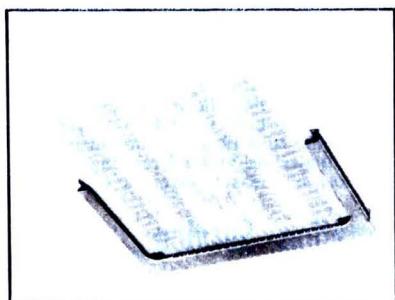
**REMITTANCES:** These must be in a form negotiable in Australia. Where the charge may be in doubt, an open cheque, endorsed with a limitation, is recommended.

**ADDRESS:** All requests for data and information, as set out above, should be directed to The Assistant Editor, "ELECTRONICS Australia," Box 2728 G.P.O., Sydney, N.S.W., 2001. Other correspondence should be directed to The Editor.

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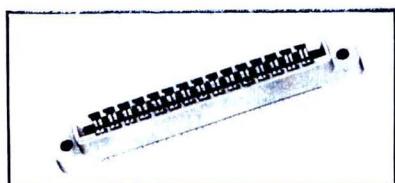


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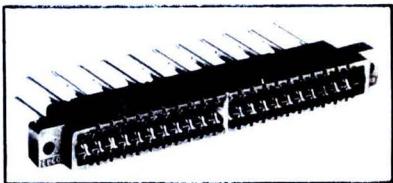
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## ANSWERS TO CORRESPONDENTS—continued

cost quite a sum of money. Could you tell me where I can obtain information on receivers used before valves were invented? (G. C., Cootamundra, N.S.W.)

● Thank you for your appreciative comments — over the years we have tried to keep our cost as low as possible, making it — as you say — reasonably priced compared with overseas journals. We published a design for a line filter in February, 1960, and again in January, 1968. Copies of these articles may be obtained through the Information Service for the usual 20c fee. For information on the really old type of receivers (using coherers, etc.), we suggest that you consult a book such as an early edition of the "Admiralty Handbook" which you may be able to obtain through a library or pick up in a second-hand book shop. Another step in reception was the crystal set, so any article describing the principles of this type of receiver would supply you with what you need.

**CONVERTER:** I noticed a request for a converter for use on emergency fire service frequencies in your "Answers to Correspondents" column. I too would be interested in such a project. In my case, the converter would have to be usable from about 2 to 5MHz. I recently noticed several circuits in the G.E. Handbook and the A.R.R.L. Handbook just published. These circuits have been based on FET's and have a low voltage supply. If such a circuit is designed, it would definitely be an advantage if it could be operated from a 6 or 12V battery. In my case, the converter would be used with a car radio. (R.J.C., Morphett Vale, S.A.)

● Thank you for adding your weight to the argument in favour of this project. As you say, a battery operated version would probably be most useful. We have noted the circuits you mention for possible future reference.

**YOUTH RADIO SCHEME:** I have been following your reports on the Youth Radio Scheme and I am very interested, but cannot get any details on membership, etc. I hope you can help me. While I am writing may I congratulate you for your first class magazine. (L.M.C.C., Upwey, Vic.)

● Thank you for your expression of appreciation of our magazine. For details about the Youth Radio Scheme contact the Wireless Institute of Australia in your State. The Victorian address is P.O. Box 36, East Melbourne, Vic. 3002.

**CONVERTER:** I am a younger reader of Electronics Australia and therefore have a limited budget. I would like to suggest a two transistor short wave converter, suitable for use with a six transistor set. The reason why it must be a two transistor converter is because I have an Electronic Set which has two transistors. Keep up the good work of a wonderful magazine. (K.H., Cheltenham, Vic.)

● We will consider the suggestion for a two transistor short-wave converter, but as your kit has only two transistors they are probably audio types and therefore unlikely to be of much use in a short-wave circuit. In the meanwhile, perhaps you might like to try building a small transistor short-wave receiver. A suitable design (two transistors) was published in June, 1960, and another (three transistors) in June, 1965. Copies of these articles are obtainable through the Information Service for 20c each.

**FUZZ BOX:** I built up your Playmaster 117 Guitar Amplifier from a kit supplied by one of your advertisers. I wish to express my delight at its performance. The only adjustment I made was to the bias supply. I am afraid I must express dissatisfaction with the companion fuzz box. Along with several friends, I find

that the extremely high harmonic content to be more in the nature of what we term "treble-boost" which often consists of a small transistor amplifier with the emitter bypassed by a 0.1uF capacitor instead of 25uF. We look for a harsh, rattling sound from a fuzz box. Lastly, the monophonic organ is a great little gimmick, but I am eagerly awaiting the issue that contains a full circuit of a complete organ, even if requiring some experimentation to provide a number of voices. (C.W., St. Marys, S.A.)

● We are pleased that the guitar amplifier was to your satisfaction. In the case of the fuzz box, however, we are surprised at your comments. Our prototype certainly didn't sound merely like a "treble-boost" type of circuit, and we are inclined to think that you have a fault in your fuzz box. We have no definite plans for the publication of the design for an electronic organ.

**AUDIO MIXER:** Could you please supply me with specifications and data to enable me to construct a quality four-way audio mixer suitable for use with a combination of four different commercial units? I desire to produce a tape for a slide show and would appreciate suggestions for any text books that may assist me in my effort. (B.G.O., Singapore.)

● We have described a number of 4-channel mixers, the latest being in February, 1966, and February, 1967 — the latter being intended for high impedance inputs. We cannot say whether they would be suitable for your requirements as we do not keep files of commercial equipment and therefore do not know which circuit would be most suitable for the units you are using. If you can be more specific, we can supply copies of the articles for 20c each. We would suggest that you contact one of the leading technical booksellers, either in your own country or one who advertises in our magazine, for assistance with your tape problem.

**YOUNG AMATEUR:** I am becoming increasingly interested in amateur radio. I am 14 years of age and I am in the middle of building an all-wave mains receiver. I was wondering whether you could please publish a list of countries and their amateur call signs so that I could recognise them when listening to my set. I think a lot of people would appreciate this list. I also wonder if anyone about my age, who is interested in electronics and amateur radio would like a pen friend. (Neville Franks, 29 Amella Street, McKinnon, Vic. 3204.)

● The official list of countries and their call signs is published by the Wireless Institute of Australia in its magazine "Amateur Radio" once a year. A similar listing appears in each edition of the A.R.R.L. Handbook. We reproduced the W.I.A. list for 1966 in our May, 1966, issue and copies of this list may be obtained through the Information Service for 20c. We have published your full name and address so that any of our readers who care to correspond with you may do so. If you are interested in meeting people of your own age who share your liking for amateur radio, it might be worth while thinking about approaching the W.I.A. in your State to find the nearest branch of the Youth Radio Scheme.

When writing, please make sure your address is complete, including the POSTCODE. Addition of the latter will ensure minimum delay in handling your letter. Also make sure that your address is legibly written or, for preference, PRINTED. A significant number of letters are returned to us each month because the original address was incomplete or illegible.

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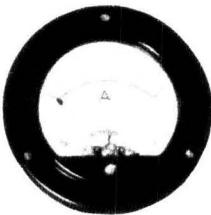
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100 uA . \$5.75 25 volts d.c. . \$5.50

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10K — 12K — 15K — 18K — 22K — 27K —

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560K — 680K — 820K.

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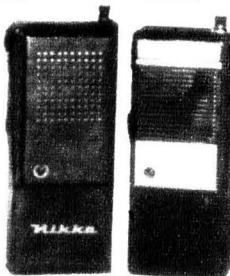
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3 1/4 inch . . . . . 35c

4 inch . . . . . 40c

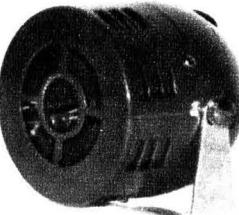
5 inch . . . . . 40c

5 1/4 inch . . . . . 55c

7 inch . . . . . 50c

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## ANSWERS TO CORRESPONDENTS—continued

**METAL DETECTOR:** I am interested in building a metal detector which will detect non-ferrous as well as ferrous metals. I should appreciate it if you inform me whether your magazine has published plans for one. If so, would you please advise me as to what issue the plans appear in, whether any copies are available and the price. (K.W.B., Merrylands, N.S.W.)

• The only project which we have described in this field is a Pipe and Wiring Tracer. This article, published in September, 1965, described a device which allowed pipes, etc., to be traced by injecting a signal at some convenient access point. It will not locate completely buried objects. Copies of the article describing this device are available through the Information Service for the usual 20c fee.

**SLEEP LEARNING:** A subject in which I am rather interested is that of sleep learning—the absorption of knowledge from pre-taped information, while sleeping. I have found no mention of any article covering this subject in your magazine. If you have featured it, I would like copies of the articles and, in particular, something on the automatic control of a tape recorder to perform the function. (K.G., Vatukoula, Fiji).

• We've probably made mention of sleep-learning on a number of occasions but we have nothing to offer in the way of a lengthy discussion plus how-to-do-it information. In fact, it is a subject about which there is a lot of argument and speculation . . . whether it works for everybody, or only a few or at all; whether the information is effectively assimilated or whether it has to be confirmed by normal, related teaching sessions, etc. For many people, also, the anticipation of what is to happen when they are asleep may be sufficient to keep them awake! Sorry, we can't help immediately.

**30W P.A. AMPLIFIER:** I am interested in your 30W transistor amplifier (May, 1968) but wonder whether modifications could be made to improve the frequency response and raise the input impedance to 50K. I would like to use it for guitar-microphone work in small halls. Congratulations on the production of a consistently good magazine. (J.McG., Brisbane).

## Documentary Records

(Continued from page 101)

Crawford has a less spectacular role as the "Bloke's" sweetheart but with "My Sentimental Bloke" she has the prettiest song in the show to make up for this. In the "Ginger Mick" song "Rabbit Oh!" Jimmy Hannan makes only a routine job of singing this perky number.

Apart from a quite excruciating wrong note by the solo oboe in the overture—a small edit would have corrected it—the orchestra sounds fine. A few more strings would have enriched the sound but this is only a small complaint.

As a sortie into the tricky world of stereophonic recording this is a creditable if not daring piece of recording but I must add that the clarity of the sound is admirable. In the words of one of the songs, "I dips me lid" to an enterprising effort which does Australia's most popular home-grown musical proud.

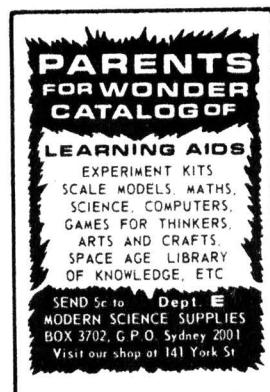
• What you are asking would involve a virtual re-design of the amplifier and this would be right outside the scope of our query service. However, you would probably find that the amplifier would work well for you as it is. The frequency range would be adequate for a normal guitar and what would be lacking is not "improved frequency response" but an ability to exaggerate treble and bass response, as is common with guitar systems. The present 10K input impedance would probably work with your guitar, the more usual 50K figure being a guide target rather than a rigid lower limit. The lowered input impedance might result in a certain amount of bass boost from the guitar, which wouldn't be a bad thing anyway. Microphone performance should be adequate, provided you use a good quality magnetic unit.

**AUTOMOTIVE TEST EQUIPMENT:** On page 167 of the September issue, J.M. (Beaudesert, Qld.) inquires about home-made automotive test equipment. You might like to be aware of the book "Rapid Car Fault Diagnosis" by G. C. Sneed B.Sc. published 1964 by C. Arthur Pearson Ltd., Tower House, Southampton St, London, WC2, England. The cover price is 30/. To quote the author, "this book contains details of how to construct comparatively inexpensive test equipment simple and accurate units that can be built by anyone with a little engineering knowledge." It contains details of vacuum and pressure gauges, electronic tachometer, stroboscopic ignition timer, coil spark meter and ignition component test unit, spark plug tester, fuel pump tester, hydraulic system tester, wheel adjustment gauges, etc. (R.F., Modbury, S.A.)

• Thank you for the reference which may be of value to readers interested in this subject. We would be glad to know how you get on with the projects after you have had time to build them and particularly whether you had any special problems in obtaining the necessary components and arranging appropriate means of calibration.

**DATE ON SPINE:** Would it be possible to print the dateline along the spine of "Electronics Australia"? I file my copies flat and have to print the date on each. (G.N., Hamilton, N.Z.)

• We'll talk this one over with our printery. It is a natural thing to do with a square-stitched journal but not usual with saddle-stitched or stapled binding. The problem is to keep the printing symmetrical along the fold line—or rather the reverse. If this can't be controlled accurately, the result could be rather untidy. ■



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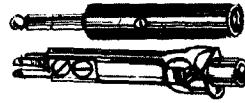
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# PLAYMASTER 123

(Continued from page 67)

other coil and proceed as before. Remove the damping resistor.

Apart from alignment, a number of other adjustments have to be made for optimum performance. The audio output potentiometer may have to be turned back to avoid overloading the input of the amplifier or control unit.

The amount of aerial and the setting of the aerial attenuator will be dictated by the location. If there are no strong signals, several feet of aerial will be needed with the attenuator turned right up. At the other extreme, if you are close to one or more stations, just a few feet of aerial will suffice and the attenuator may have to be turned well back. The criterion of attenuator adjustment is that it must be set so that cross-modulation from a strong signal on other stations is not a problem. It may be necessary to arrive at a compromise with this setting and it can only be determined by experiment.

The whistle filter is the only item left for adjustment. If you use an RCS filter it should be already quite close to frequency. Set the 100K potentiometer on the filter to about mid-position. If you are lucky, you may not have to make any further adjustment. If the 10KHz whistle is still audible, adjust the screw in the centre of the pot core slowly and carefully, for maximum attenuation. Then the 100K potentiometer is adjusted for further attenuation. This process should be repeated for best results.

As with all radio tuners, it is important that it be tuned correctly to the wanted station. Proper use of the tuning meter will ensure correct tuning. Tuning is somewhat more definite when the switch is set in the narrow position. So if you prefer this method, set switch to narrow, tune and then switch to wide.

Incidentally, if readers encounter any problems in obtaining the special components required for this tuner, a list of sources was given at the end of the article in the August issue, on page 71.

## Errata and Notes

### PLAYMASTER 122 PROGRAM

SOURCE (August, 1968). Coded photograph, p. 69. Base resistor of TR4, 4.7K, should read 33K. Emitter resistor by-pass capacitor of TR6, .047uF, should read .0047uF.

## THE SERVICEMAN

(Continued from page 83)

to produce any results and I was beginning to doubt the effectiveness of the idea. In fact, I eventually reached the stage where all the components in that stage had been tested, except the transistor. And, since everybody knows that transistors don't develop faults like this, I almost hesitated to test it.

Imagine my reaction when, on touching the top of the transistor, the system sprang into life almost immediately. Could it be coincidence? I tried again, concentrating the spray in the direction of the transistor this time and giving it a good burst. Once again, my finger had hardly touched the

top of the transistor before the system came good. After a third try I was convinced; it must be the transistor.

The ultimate test, of course, was to replace it. This I did, and dispelled any lingering doubts by completely curing the trouble.

While discussing my success later with the colleague who had introduced me to the freezing technique, a couple of interesting points emerged. He pointed out that I had used a technique exactly opposite to that which he had used in his TV camera fault. In this case he had used a blanket heating of the suspected area, followed by localised cooling to pinpoint the component. In the larger and more open form of construction used in this equipment this was perfectly practical. In my case I had used blanket cooling of the suspect area followed by localised heating to pinpoint the component. This seems to be a logical approach in crowded areas.

The second point concerned the possible nature of the transistor failure. This was of purely academic interest but, nevertheless, made interesting speculation. My colleague, who knows a good deal more about the "innards" of transistors than I do, first of all described the construction of the transistor involved. It was a small black plastic unit which my colleague somewhat loosely described as "a plastic TO18." The top of the black plastic cylinder is slightly domed and it is within this dome, I learned, that the actual "works" are contained.

Initially, the black body has a flat top and is moulded with the three pig-

tails passing through to the top and protruding slightly. The actual "chip" is cemented to this, and connected to the appropriate pigtails with fine bonding wires. Finally, a small blob of epoxy is added to the assembly and settles into the familiar dome shape. My colleague suggested that the most likely cause of the fault was a broken bonding wire, or faulty junction to either the chip or pigtails, with only a microscopic gap.

Since it was the domed top of the transistor on which I had placed my finger, it was easy to understand why it responded so rapidly to the change in temperature.

So there it is, another angle you can add to your intermittent techniques. It may not work every time, but I have a feeling that it will turn out to be one of the most effective single ideas to come our way for a long time. ■

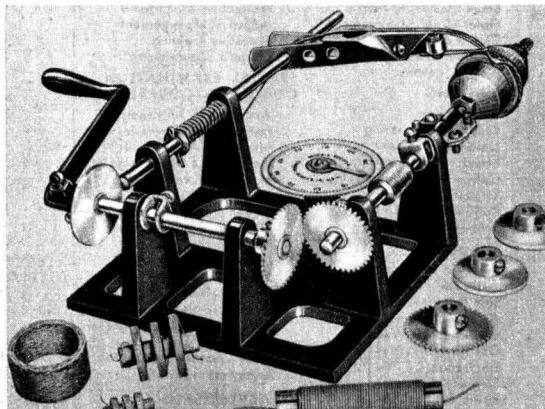
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# Short History of the "Talkies"

(Continued from page 15)

done on this system for many years, as it appeared at the time to be less promising than disc recording or photographic recording.

The discovery was not forgotten, however. In 1923 a U.S. patent on magnetic sound recording for motion pictures was granted to E. Peterson, another Dane who had spent some years working with Poulsen in Denmark before migrating to America. Peterson's patent described a system whereby the sound signals were recorded magnetically on a wire imbedded in the marginal area of the 35mm film.

In the late twenties and early thirties considerable effort was spent on developing magnetic recording in Germany. By the late 1930s German engineers had produced a practical magnetic recording system using plastic tape coated with a magnetically active layer of iron oxide.

During this time work had been done in America and elsewhere into recording on fine steel wire, and the first rather crude wire recorders and dictating machines had appeared. However, when World War II came to a

close it was found that the performance of the German tape recorders was significantly better than that which had been achieved with wire, and magnetic tape recording rapidly came into use in broadcast stations, recording studios and eventually in the home.

In 1947 the DuPont company developed magnetic recording film, consisting of a magnetically coated 35mm film with standard perforations. It was soon found by RCA and other big recording companies that this material was capable of a performance which was far superior to that of photographic sound recording. Apart from this, it had the important economic advantage that it could be erased and reused over and again, whereas photographic film could be used once only. And there were more practical advantages, such as the ease with which the magnetic recordings could be replayed after a "take" to determine if they were satisfactory.

The motion picture producers were not slow in seeing the advantages of magnetic recording. By April, 1950, Paramount were reportedly using it for all their master sound track record-

ings and dubbings, while by the end of 1951 about 75 per cent of all Hollywood production companies had followed suit. Photographic sound recording was being used only for the final recording on the release prints.

In 1952, magnetic sound was used for the first time on release prints, when Hazard E. Reeves brought out the first Cinerama production, "This is Cinerama." The next year, Fox—now 20th Century-Fox—adopted magnetic sound for its "first run" release prints of CinemaScope.

Since then, magnetic sound has been used increasingly for release prints, although mainly for the wide-screen formats using film wider than 35mm. There still remain many thousands of theatres with equipment capable of reproducing only photographic sound tracks, and economic pressures have brought about resistance to a complete changeover to magnetic sound.

In fact, the use of photographic sound for release prints is not a bad thing, as the performance is probably quite adequate for most requirements while a photographic recording is somewhat more durable than a magnetic recording in typical transport and exhibition environments. The photographic record may become a little scratched and noisy after many showings, but at least it cannot be wiped out completely, simply by accidental placement of a spool on an arc lamp transformer!

Apart from its use in the studios, magnetic sound has found one other use in motion pictures: amateur sound movies. For most amateurs, magnetic sound is the only practical means whereby they can provide their films with sound, combining moderate simplicity with reasonable cost. ■

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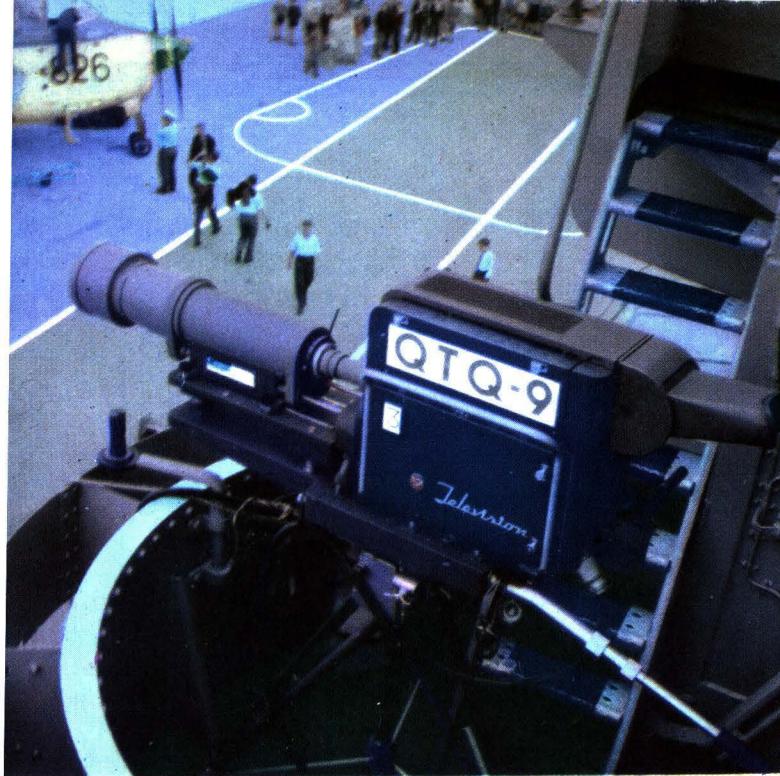
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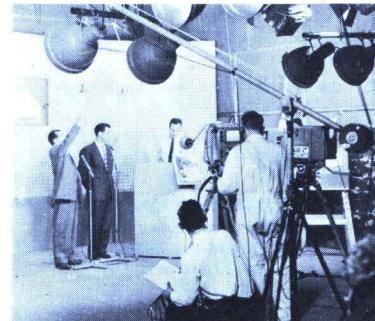
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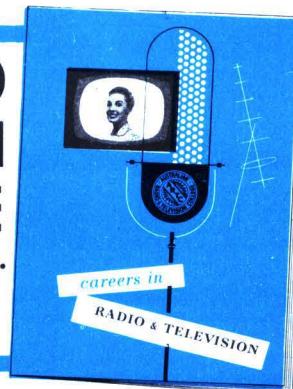
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